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VINCENT SQUARE LONDON S.W.1

The Time will come when thou shalt lift thine eyes
To watch a long drawn battle in the skies.
While aged peasants, too amazed for words,
Stare at the flying feet of wondrous birds.

England so long the mistress of the sea,
Where wind and waves confess her sovereignty,
Her ancient triumphs yet shall bow on high
And reign the sovereign of the conquered sky.

Thomas Gray. 1737

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FLIGHT and The AIRCRAFT ENGINEER

FIRST AERONAUTICAL WEEKLY IN THE WORLD : FOUNDED 1909

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The Outlook

Napier Electrification

PURELY on sentimental grounds many may regret the recent acquisition by the English Electric Co., Ltd., of the ordinary shares of D. Napier and Son, Ltd., a transaction which was accepted by the holders of 80 per cent. of the Napier ordinary shares. When control of an old firm passes into new hands there follows the usual speculation and concern about the future.

In this case it appears almost definitely that the association of the two firms concerned will be of mutual benefit technically. The Napier company has had an unbroken record of association, first with the automobile industry, and afterwards with aircraft engine design and manufacture. From small beginnings the company has grown to impressive size, and its factory space has been expanding gradually as and when the demand dictated. Thus it shared with many others the disadvantage that factory layout could not be planned on such modern lines as those incorporated in works laid down at a more recent date. With the fusion of Napiers and English Electric, one may expect that the vast manufacturing resources of the latter will be made available for the large-scale production of Napier designs. The Napier-Halford Sabre engine has already been announced, and the enemy is well aware of its existence, so the new chairman of the company, Mr. G. H. Nelson, need hardly have been quite so reticent in his recent speech at the annual general meeting of the company, when he made no reference to the firm's present activities "for security reasons."

The foundations of Napier fame, so far as aircraft engines are concerned, was laid with the Lion engine, a 12-cylinder W-type water-cooled, which began its career at the modest rating of some 450 h.p., but which was gradually developed to give a good deal more. Perhaps no better illustration of the success of the Lion could be given than by recalling that one year the profits of the company were in the neighbourhood of £250,000. That was in the days when orders for the aircraft industry were few and small, so that the figure was a good deal more impressive than it would be to-day. The Lion was produced while Mr. A. J. Rowledge was chief designer to the firm, and Mr. H. T. Vane was managing director.

Even the Lion engine, good as it was, could not last for ever, and an attempt to enter the light plane market with a small six-cylinder in-line air-cooled engine was not markedly successful. Licence to build Junkers diesel aircraft engines in this country also failed to produce substantial orders, chiefly because official policy veered away from the two-stroke diesel in favour of the petrol engine using fuels of higher octane numbers.

When Major F. B. Halford was brought in to design entirely new types of engine, the vogue of the "H" type began, first with the 16-cylinder Rapier, and then with the 24-cylinder Dagger. Both these were air-cooled. Most recently came the Sabre liquid-cooled 24-cylinder sleeve-valve engine, which is now the only announced British aircraft engine in the "over 2,000 h.p." class. The announcement that Major Halford is to continue as technical head of the firm will be welcomed.

Although originally and still mainly electrical, mechanical, hydraulic and general engineers, the English Electric Co., Ltd., is by no means a newcomer to the aviation industry. Its connection with that industry began during the 1914-18 war, and it may be recalled that flying boats were manufactured in Lancashire to the designs of Mr. W. O. Manning, one of the pioneers of British aircraft designers. For the light plane trials at Lympne, Mr. Manning designed the little Wren monoplane, which flew remarkably well with an A.B.C. two-cylinder engine of about ten actual horse-power. When

the slump years came, the English Electric Company closed down its aviation department, thus ending, but only for a period, its aviation history. A new chapter was opened when the expansion scheme came into being, and now the company is to devote its attention to large-sized power units which are so much needed for war service and after war use in large civil types.

Aircraft and U-boats

IN the weekly record of the "War in the Air," *Flight* has often remarked that there is no way in which Bomber Command can make a more useful contribution to victory than by destroying U-boats in their bases or their factories and by smashing up related industries such as the diesel engine works at Augsburg. It is therefore rather disturbing to read an article by Lord Hankey in the *Sunday Times* of January 3rd, in which he says that "sporadic bombing" of those targets has not produced "appreciable results."

Lord Hankey is seriously disturbed by the present position of the Battle of the Atlantic and the menace to our shipping. He says that during the war, despite a record shipping output, our losses are more than double their replacement. He does not make it clear whether that statement includes American losses and building. It may also be the case that the present position has altered so much from that in the early stages of the war that an argument based on figures for the whole war may be misleading.

Without doubt sea power is the basis of our strength in our struggle with the Axis, and again it is disquieting to read Lord Hankey's opinion that "on any calculation" our striking power in the present year will exceed our capacity to transport it.

It is certainly true that it is more important to destroy and frustrate U-boats than to replace the ships which they sink, and last Saturday's American raid on St. Nazaire was one piece of good work. Lord Hankey believes that the true solution of the problem lies in making more use of long-range aircraft equipped with special scientific apparatus, which, of course, is not to be described in print. All aggressive devices certainly ought to be employed with full vigour, and it is to be hoped that the urgings of Field Marshal Smuts are bearing fruit in this matter; in fact, there are signs that they are doing so. For a long period last year British bombing policy was to prevent German war material being sent to Russia. It is now a question whether Russia and all the United Nations would not be most benefited by concentration on the U-boats' nests.

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Any Advance?

IN A WORLD OF SPACE *by F. Gordon-Crosby*

THIS magnificent coloured picture by our artist, F. Gordon-Crosby, has been presented by "Flight" to the Royal Air Force Benevolent Fund, and is now in the hands of the Honorary Secretary, to be put up for sale to the highest bidder. The painting depicts a Hurricane pilot following down a comrade's attack upon a defeated two-engined enemy plane, the port engine of which is emitting a thick curving column of smoke high up into the blue and white alto-cumulus, for all the world as if about to administer the coup de grace. The initial attacking craft, with its faint vapour trail, can be seen sheering off into the blue.

Reproductions of the painting have been seen by hundreds of thousands of the general public (to say nothing of readers of "Flight"). Thus, specially executed by our artist, the painting has already a history. It was utilised on Christmas cards and calendars sold in aid of the R.A.F. Benevolent Fund by Raphael Tuck & Sons, Ltd., during the past three Christmas seasons. Also it was H.M. the King's choice of Christmas card to the R.A.F. in 1939. It is not without interest also that the artist's first original was destroyed when Raphael Tuck's premises were gutted in the memorable German incendiary air attack on the City of London just over two years ago.

Entitled, "In a world of Space," the framed picture measures 39in. × 32in., and "Flight" sincerely hopes the bidding will be high and spirited; not alone for the worthy cause to benefit from its sale, but because the painting, well known as it has become, is the work of an artist unexcelled in the pictorial delineation of the mechanistic element of modern days. "Flight" will be happy to report any bids received by post to the proper quarter, and has already one of 50 guineas.

GOING AT 50 GUINEAS?

RANGE AND POWER: A four-cannon Hurricane IIC over Tunisia. The long-range tanks enable escorting fighters to cover the bombers during the whole journey.

WAR in the AIR

A Retrospect : Economy of Bombing Raids : Effect on German Communications : The Great Russian Advance

THE Air Ministry has indulged in an official review of the year 1942, the most critical year of the war. The war took a new turn with the entry of Japan, fully armed, on the one side, and of the United States, still unarmed, on the other. Everything depended on whether Russia could hold out, and the Allies had to do everything in their power to help her to do so. During that period the only offensive action which Britain could take was through Bomber Command. During the year the R.A.F. increased by more than a third, but Bomber Command had to divert many of its energies and much of its supplies from its attacks on German production. Nevertheless, its offensive grew in power. In Germany there are between 50 and 60 major industrial centres. Of these 28 were attacked during the year by forces of over 100 bombers at a time. Some places were attacked several times, so that in all there were 88 raids of this description.

These bombing raids are claimed to be a very economical way of hitting the enemy. The raid by over 1,000 machines on Cologne was contrasted with the Combined Operations raid on Dieppe. In each of these operations the British Empire sent into battle about the same number of officers and men; but whereas the casualties at Dieppe were very heavy, at Cologne we lost only 257 members of the aircrews, that is to say, about one man for every factory destroyed. The losses in the bombing raids on the Renault and Matford works were also light.

The Air Ministry admits that the effects of the bombing are hard to assess, in both the material and the *moral* spheres. It is known, however, that imports of iron ore from Sweden to Germany fell during the year by

NORTH AFRICAN INTELLIGENCE: Aircrews of a light bomber squadron reporting to the Intelligence Officer after a night raid on Tunis.

TRYING THEM OUT: A number of enemy aircraft captured in Libya have been made serviceable and given R.A.F. markings. (Top left) With much satisfaction the swastika is blotted out on the tail of a Me 109E. (Top right) An adapted Me 109F taxies in after a test flight. The split flaps are seen opened out to act as an air brake. Acute tail buffetting would be expected from the operation of these flaps and this may have some bearing on the high tailplane position. (Bottom left) Filling up the fuel tanks of a Junkers Ju 87D. (Bottom right) A number of "whistlers," the music of which will be appreciated by the Germans.

WAR IN THE AIR

one million tons, which would have been enough to make steel for ten battleships or 20,000 medium tanks. This is attributed partly to the constant R.A.F. attacks on German communications and on the coalfields of the Ruhr. The effect on *moral* is even harder to estimate, but it is believed that the efficiency of German labour during the year was only 60 per cent. of what it was in 1939. The reasons given were that many of the workers now have to live at a distance from their work, because of the devastation in so many cities, thus using up transport, fuel and time in getting to and from their work, and that this increases physical weariness at the end of the day. It is also believed that war weariness is prevalent among the workers. It might have been added that many thousands of the workers come from occupied territories and have no heart in their work. Many of them undoubtedly long to see Germany defeated; and to be set free to return to their homes.

The Royal Air Force is now stronger than the combined Air Forces of Germany and Italy, and is still growing. American production has outstripped that of the two European members of the Axis, and is also still growing. During the year the enemy was only able to concentrate his full air power on one front, namely, against Russia, and, even so, he was obliged to keep a large proportion of his fighters in France to counter the raids of the R.A.F. The year ends with a second front established in French Africa, while Italian Africa is almost in British hands. To build up his forces in Africa the enemy had to rely mostly on air transport, which is naturally less economical and less efficient than sea transport, and he had to use many bombers as transport aircraft and numbers of Ju 88s as night fighters, thus further reducing his fighting strength.

The Air Staff definitely declined to express the opinion that we could win the war by bombing alone. As Russia is bearing the brunt of the fighting, the Air Staff holds that it is a priority duty to assist her in every way, both by sending her aircraft and by attacking German communications. The effect of these attacks on railways and shipping has hardly received the attention which it deserves. One begins to realise its importance when one hears that since the spring of 1942 one Group in Fighter Command has shot up more than 400 locomotives in Western Europe. No wonder it is difficult to transport iron ore from Sweden!

The Russian Offensive

THE Russian armies have been sweeping forward in the wintry weather which so hampers the Germans and their satellites but seems to suit the natives of the country. In these movements there have been few allusions to the work of the Red Air Fleet, but occasionally the efforts and failures of the *Luftwaffe* come in for notice. The Germans are resisting stoutly, as one knew that they would do, and they are ingenious in planning

ambushes. One reads of sudden sallies from villages by tanks and mobile artillery, supported by Stukas, but these incidents produce little effect.

A very striking fact is the number of German aircraft which the Russians claim to have captured intact. For instance, on the southern front, from the middle Don to south of Stalingrad, the Russians claim that in six weeks they captured 542 aircraft besides other booty. This suggests that the Germans are short of petrol, and the comparative inactivity of their army which was lately trying to capture Stalingrad points in the same direction. In the same period and on the same front the Russians say that they have destroyed 1,249 aircraft, but do not mention how many were shot down in combat and how many fell to A.A. fire. Some may have been destroyed on the ground by bombs or shells.

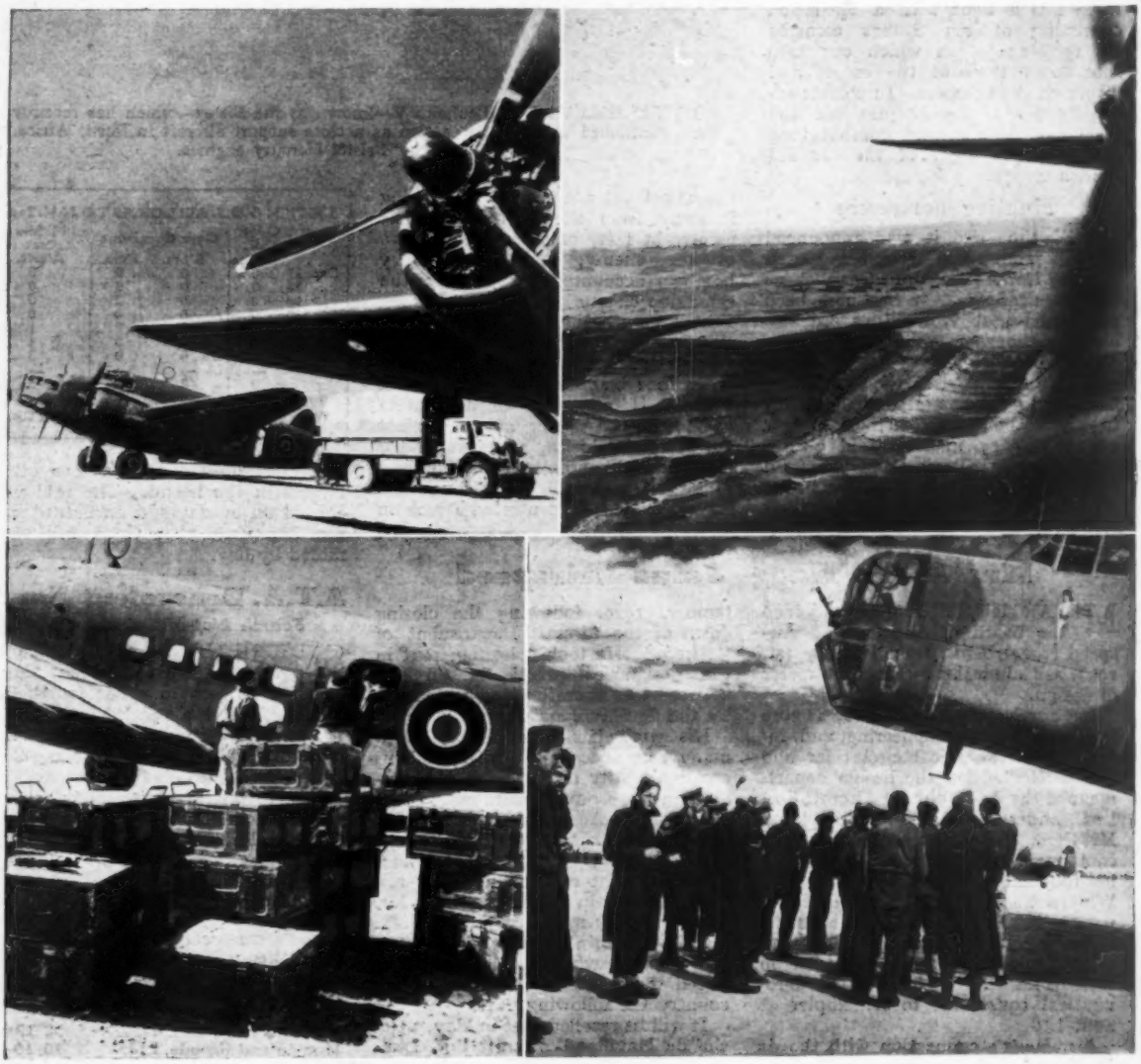
WAR IN THE AIR

On the last day of 1942 eleven German transport machines are stated to have been shot down in the Stalingrad area, an item which tells its own story and suggests even more than it says.

In Africa

FOR some days the weather reduced air activity in Northern Africa, but, none the less, Middle East aircraft, doubtless based on Malta, took every opportunity to bomb Tunis and La Goulette.

Right at the end of December the weather improved, and there was more air activity over the path of the Eighth Army. On December 30th Empire fighters shot down five out of a patrol of ten Me 109s, and later



DESERT TRANSPORT SQUADRON : In addition to its great offensive against the enemy in North Africa, the R.A.F. has played an unprecedented part in bringing up supplies for the advancing Eighth Army. The speed of Rommel's retreat put a strain on General Montgomery's communications. Under a preconceived plan, however, R.A.F. transport planes brought ammunition, petrol, rations and water up to the forward British units, enabling them to carry on the pursuit across Libya without a break. The R.A.F. Transport Squadron's most spectacular operation was the "lifting" of an entire fighter force, which was set down on a landing ground well inside enemy territory.

(Top Left) Army lorries with supplies to be transported arrive in convoy and the loading up of the aircraft begins. (Top Right) The steep cliffs at the edge of the escarpment near Sollum seen from a Bristol Bombay of the R.A.F. Transport Squadron. (Bottom Left) The aircrews help to unload boxes of ammunition for armoured units. (Bottom Right) Walking casualties from the battlefield wait to take their places in a Bombay on their way back to base.

WAR IN THE AIR

ENEMY AIR LOSSES TO JAN. 2nd

	Over G.B.	Over Continent	Middle East
Dec. 27	0	0	1
" 28	0	0	0
" 29	0	0	1
" 30	0	0	8
" 31	0	2	0
Jan. 1	0	0	0
" 2	0	0	2
	0	2	12

Totals : West, 6,530 ; Middle East, over 5,148.

there was a fight with a formation consisting of ten Stukas escorted by 15 Me 109s, in which our men shot down three of the escort and dispersed the bombers. In neither engagement did the Empire lose any machine. The second combat took place right in sight of the forward British troops.

Fighting Fortresses

SOME time ago it was announced that Hampdens were being used in the North Sea and Channel as torpedo droppers. It has now been mentioned that Wellingtons are also used in the same role in the Mediterranean.

In French Africa the Fortresses have again demonstrated their ability to wipe the eyes of their fighter escorts. They made a raid on La Goulette, near Tunis, being escorted by P 38 fighters. A large formation of Axis fighters assailed them, and the escort did not succeed in keeping it away from the Fortresses. The escort, in fact, only shot down two of the enemy, while the heavy bombers accounted for 19. On the same day enemy bombers with strong fighter escorts attacked Bône twice on the same day, but each time British Spitfires got at them and shot down four bombers and two fighters.

Crete is now one of the main enemy air bases for action against the Allies in Africa, and last Friday night British and American bombers of all categories, light, medium and heavy, made a concentrated attack on Heraklion airfield and various other targets in the island. The raid was carried on by daylight on Saturday—the first time that Crete has been raided by day.

BRISTOL BISLEY : The Blenheim V—known as the Bisley—which has recently been mentioned as being in action as a close support aircraft in North Africa. It is powered by Bristol Mercury engines.

BRITISH & U.S. AIR LOSSES TO JAN. 2nd

	Over G.B. A'crft.	Over Continent B'brs.	Over Continent F'trs.	Middle East A'crft.
Dec. 27	0	0	0	0
" 28	0	0	0	0
" 29	0	0	2	0
" 30	0	0	0	0
" 31	0	2	2	1
Jan. 1	0	0	0	1
" 2	0	0	0	3
	0	2	4	5

Totals : West, 5,005 ; Middle East, about 2,004.

Mr. A. E. Hagg Joins Airspeed

MR. ARTHUR E. HAGG has joined the board of directors of Airspeed (1934), Ltd., from January 1st, 1943, as technical director and director of design.

Mr. Hagg is a very well-known figure in British aircraft engineering, and, indeed, in aeronautical circles far and wide. He headed the design department of the de Havilland Aircraft Co., Ltd., under Captain de Havilland and Mr. C. C. Walker from 1920, when the company was formed, until 1936, when he founded his own business, the Walton Yacht Works, Ltd., of Shepperton, of which he has since been the governing director and chief designer ; this company is entirely engaged on war work. Later he became aeronautical consultant to D. Napier & Son, Ltd.

Mr. Hagg's connection with the de Havilland organisation goes back to 1915, when he started working with Captain de Havilland at the Aircraft Manufacturing Co., Ltd., Hendon, where, amongst other war types, the DH.4, 9, 9a and 10 were created. He was one of the 50 or so individuals of the original de Havilland Aircraft Co., Ltd., when it was founded at Stag Lane Airdrome, Edgware, in September, 1920, following the closing down of the Aircraft Department of "Airco." He took a leading part in the design of practically all the between-war aircraft types turned out by the de Havilland Company.

His work has thus been seen in many very successful aircraft and his creative ability came to the fore notably in the Comet racer, which won the England-Australia Race in 1934, and the Albatross 13-ton liner.

Incidentally, it was the Comet which brought out the need for c.s. airscrews and in February, 1934, Mr. Hagg visited America with Mr. F. T. Hearle, the firm's managing director, as a result of which de Havilland produced their first c.s. airscrew in this country the following year.

It will be recalled that in May, 1940, the de Havilland Aircraft Co., Ltd., acquired a controlling interest in the Airspeed Company, whose production during the war years has been concentrated in the Oxford. Mr. Hagg's appointment to the Airspeed board will, therefore, bring him again into close association with the de Havilland Company, whose principal design achievement so far in this war has been the Mosquito bomber.

A.T.A. Benevolent Fund

Fourth List of Subscriptions

SUBSCRIPTIONS to the Air Transport Auxiliary Benevolent Fund continue to flow in. The fourth list of donations is appended. On going to press we understand that the directors of the Bristol Aeroplane Co., Ltd., have decided to contribute £1,000 to this deserving fund.

Cheques should be forwarded to Comdre. Pauline Gower, Sec., A.T.A. Benevolent Fund, White Waltham, near Maidenhead, Berks.

	£	s.	d.
Subscriptions already acknowledged	3,407	14	7
Vickers-Armstrong, Ltd.	500	0	0
Short Bros. (Rochester & Bedford), Ltd.	105	0	0
Blackburn Aircraft, Ltd.	100	0	0
S. Smith & Sons (Motor Accessories), Ltd.	52	10	0
Heenan and Froude, Ltd.	10	10	0
Essex Aero, Ltd.	10	10	0
City of Birmingham Gas Dept. Holiday Fund	10	0	0
Cook & Co. (Manchester), Ltd.	5	5	0
Charles Weston & Co., Ltd.	5	5	0
Osram-G.E.C. Lamp Works	3	3	0
	£4,209	17	7

HERE AND THERE

More U.S. Aircraft in 1943

SPEAKING in the House of Commons just before the Christmas recess, Mr. Oliver Lyttelton, Minister of Production, said that while he was in America arrangements had been made for a 1943 allocation of aircraft to this country substantially higher than any figure previously discussed.

Large monthly deliveries of various types, including transport aircraft, would balance the striking power of the R.A.F. and the Fleet Air Arm.

Another "Stalag" Greeting

IN the Christmas Eve issue of *Flight* we published a letter of greeting from British prisoners of war in a German *stalag*. The following greeting from another camp of R.A.F. prisoners was also on its way, but did not reach this office in time to be published any earlier.

It comes from Sgt. T. K. May, R.A.F., the camp leader, and reads: "The N.C.O. flying personnel at Kriegsgefangengenlager Nr. 1 der Luftwaffe send to their comrades in the Services and to all friends and relatives, at home and abroad, Christmas Greetings and best wishes for the New Year."

The message was forwarded by the Prisoners of War Department of the Red Cross Society.

To these men, also, we wish a safe return home, and may it be soon!

A New Engine

APART from the 14R engine now in production with the *Gnome et Rhône* company, a corresponding 18-cylinder twin-row radial is being developed. This engine, designated *Gnome et Rhône* 18R, will have a two-speed supercharger, and is said to have the following characteristics: Diameter 55⅛in., weight 2,130lb., take-off power 2,200 h.p., continuous output in low supercharger gear at 6,890ft. 1,800 h.p.; in high supercharger gear at 22,965ft., 1,650 h.p. Maximum output in flight at 22,310ft. and at 310 m.p.h. is estimated at 2,150 h.p.; continuous output at the same speed in low supercharger gear at 11,800ft., 1,850 h.p. In high supercharger gear at 24,930ft., 1,700 h.p.

Reduction gear for contra-rotating airscrews have been designed for both the 14R and the 18R, and it is probable that they will be used for the V.G.50 aircraft referred to elsewhere in this issue.

The Me 109G in Russia

FROM reports from the Russian front it appears that the Messerschmitt Me 109G is gradually coming into wider employment. It was stated recently that some of the *Luftwaffe* squadrons operating on the Southern sector of the Russian front under General Richthofen are equipped with this type. It will be recalled that the Me 109G was said to be powered with an air-cooled engine of 1,700 h.p., while other reports state that it employs a liquid-cooled direct-injection engine of the same horse-power.

Heavy Wing-loading

IT is presumably equipped with a pressure cabin and said to have a service ceiling of over 40,000ft. Despite this ceiling, it has apparently a very high wing loading, due to the heavy armour protection, and is therefore not very manœuvrable.

The back of the pilot's seat is differently armoured from that of other Messerschmitt types, and armour plating behind the petrol tanks is said to be provided. The armament is composed of three cannons of 15 or 20 mm. and two machine-guns. The maximum speed at 13,000ft. is reported to be 325 m.p.h.

The R.A.F. on the Screen

A LARGE party of journalists was entertained at the Air Ministry last week to see a film record of R.A.F. fighting activities. The films shown had already been displayed to the public in the newsreels of various kinematograph companies. The historical value of the collection is great, and should be of immense value to future generations of officers and men in the Air Force.

From the purely photographic point of view it was inevitable that the demonstration should be uneven. Large sections, in fact the majority, had been taken during actual war operations, when the cameramen had to make the best of whatever conditions prevailed. Some sections, however, were distinctly good, and among them we should chiefly select the views of bombing Genoa by night, the camera being placed in one of the raiding aircraft.

Recent Appointments

LORD WIMBORNE, formerly the Hon. Ivor Guest, who during the present war has been serving in the Northamptonshire Yeomanry, has been appointed Parliamentary Private Secretary to Lord Sherwood, Parliamentary Under-Secretary of State for Air, in succession to Lord Cowdray.

* * *

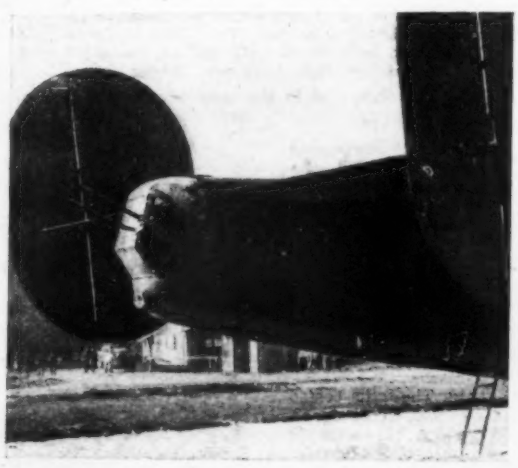
Mr. F. T. Syme, formerly executive assistant to Mr. Ralph P. Bell, director-general of aircraft production in Canada, has been appointed director of the production programme, aircraft production branch of the Department of Munitions and Supply.

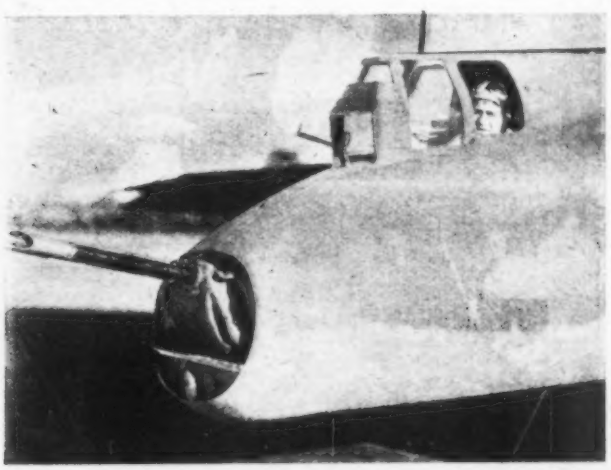
* * *

Capt. E. Grattan Thompson has been elected chairman of Parnall Aircraft, Ltd., in succession to the late Lt. Gen. Sir Louis R. Vaughan, K.C.B., K.B.E., D.S.O.

* * *

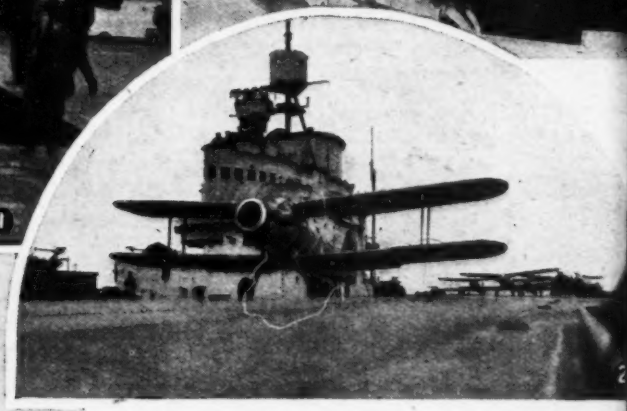
Air Marshal Sir Patrick H. L. Playfair, K.B.E., C.B., C.V.O., M.C., is to command the rearranged Eastern Command of the A.T.C., whose H.Q. at Huntingdon will be opened on January 15th. The existing H.Q. at Rickmansworth under Group Capt. T. W. C. Carthew, D.S.O., K.C., will be renamed Central Command, and will comprise A.T.C. Squadrons in Herts, Middlesex, Bucks, Oxon, Berks and Beds.





TRANSATLANTIC TAIL TURRETS: On the left is the Liberator III, and on the right the Fortress II; both are armed by two 0.5in. machine guns. The Americans favour the 0.5in. calibre and by all their official accounts of air fighting, the choice is justified.

On H.M.S. Victorious



1. A Grumman Martlet coming up on the lift to be "ranged" on the flight deck. In the background are two Supermarine Seafires.

2. A Fairey Albacore takes off with a "three start thread" of condensation from the airscrew blade tips.

6. With flotation jacket and parachute, a naval pilot climbs aboard a Martlet. Note the chocks behind the wheels to hold the aircraft against the 30-knot wind which always blows over the flight deck.

7. The steam jet in the nose which acts as a wind sock.

8. Sea Hurricanes ranged behind the wind breaks. These wind breaks lie flat when flying off is in progress.

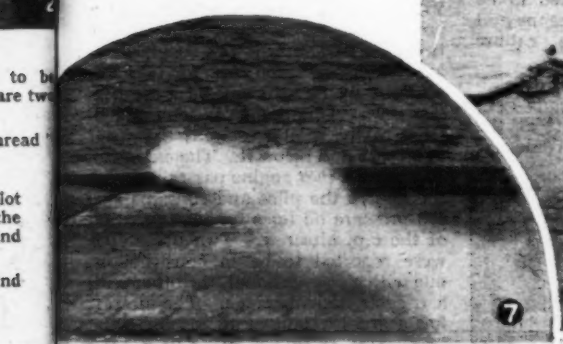
9. A Sea Hurricane comes in to land with its hook down ready to catch the arrester wires.

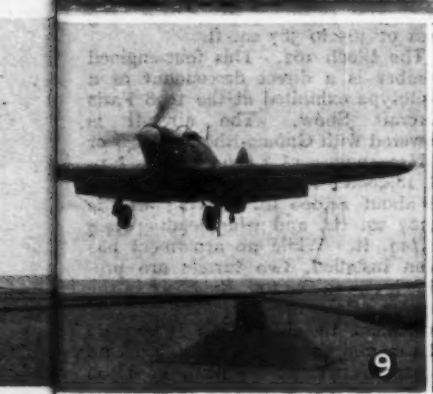
10. The duffel-coated control officer signals a Sea Hurricane to take off.

5. Cowling up a Supermarine Seafire after attending to the Rolls-Royce Merlin engine. Note the ejector exhaust stubs.

The Commander (Flying) gives orders by microphone from the "island."
Armourers attending to the .303 Browning in the wing of a Seafire.

...ried Scenes from the Steel Flight ...ck of One of Our ...west Aircraft Carriers





Modern French Designs

Recent Developments in Civil and Military Types : Contra-rotating Airscrews

FOR some time since the collapse of France, the aircraft industry either lay idle or worked for German orders. But while a large section of the industry engaged on the "collaboration" mainly worked on German types or sub-contracts, such developments as have taken place in the field of original French designs and construction of aircraft and engines merit special attention.

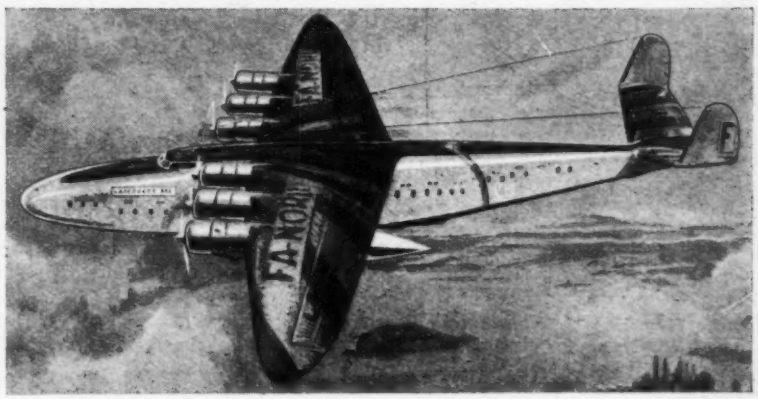
These developments were made possible by orders placed by the Vichy Government with the consent of the Nazis, and possibly with some co-operation from them.

Of the military types ordered by and produced for the Vichy Government, the following deserve special mention:

The Dewoitine D-520 single-seater fighter powered with a Hispano 12Y or 12Z engine and produced by the S.N.C.A. du Midi at their works at Toulouse. Several hundred aircraft of this type are reported to have been ordered.

The Loire-Nieuport LN 40, the only dive-bomber ever built in France. Details of this type are not available, but 24 machines are reported to have been completed by the S.N.C.A. du Centre at Bourges for the Naval Air Service.

The Bloch 157 all-metal, single-seater fighter, a development of the Bloch 155 and the Bloch 151. This is a low-wing monoplane fitted with a retractable undercarriage and camber-changing flaps, and powered with a Gnôme-Rhône 14R 14-cylinder twin-row, air-cooled radial of 1,590 h.p. for take-off, and driving a Ratier three-bladed c.p. airscrew. Wing area is 206.7 sq. ft. (187.3 sq. ft. in the Bloch 151); gross weight without armament 6,835 lb. Without armament the wing loading is 32 lb./sq. ft. and power loading 4.30 lb./h.p. The aircraft is said to have a maximum speed of 435 m.p.h. at 28,000ft. and climbs to 28,000ft. in 11 min. Range at 90 per cent of maximum performance is 620 miles, or three hours at an economical cruising consumption at 254 to 280 m.p.h. Armament is reported to be composed of two 20 mm. cannons and four 0.3 (7.5 mm.) rifle calibre machine-guns.



The Latécoère-631 is powered with six Wright Cyclone 14-cyl. engines of 1,300 h.p. and carries 40 passengers and mail. It has a range of 3,770 miles and a maximum speed of 220 m.p.h.

The Latécoère 298, a torpedo-bomber, powered with a Hispano 12Y, 30 of which have been built at the Latécoère-Breguet works at Toulouse; and the Breguet 730-02, a sea-going patrol flying boat, powered with four Gnôme-Rhône 14N engines of 1,000 h.p. each and developed from the Breguet 730.

Tandem Engines

VG 50, a twin-engined all-metal aircraft designed by MM. Vernisse and Galtier and in construction with the Government Arsenal works at Lyons-Villeurbanne. The aircraft features a power-plant arrangement composed of two Hispano Suiza 12Z engines of approximately 1,500 h.p. for take-off, each of which drives contra-rotating airscrews. One engine is mounted in front of the pilot's cockpit, the other in its rear and below it. The extension shaft of the rear engine passes between the legs of the pilot and contains also the pressure oil lines for the operation of the c.p. airscrew. Two prototypes were reported to be in construction, one with a conventional, the other with a tricycle undercarriage. The aircraft has a gross weight of 16,500 lb., wing loading of 41 lb./sq. ft., and a wing area of 365 to 387 sq. ft.

The Bloch 162. This four-engined bomber is a direct descendant of a prototype exhibited at the 1938 Paris Aircraft Show. The aircraft is powered with Gnôme-Rhône 14N48 or 14N49 engines of 1,000 or 1,100 h.p. at 18,000ft., and has a gross weight of about 44,000 lb. Wing area is 1,267 sq. ft., and wing loading 34.8 lb./sq. ft. While no armament has been installed, two turrets are provided, one in the top, the other in the bottom of the fuselage. Without the armament the Bloch 162 is capable of a maximum speed of 323 m.p.h. and a range, with useful load, of 1,500

Control cabin : The two pilots, the navigator and wireless operator at work In the centre, the bearing compass at the base of which are the ailerons and undercarriage controls. Note the suspended power plant controls, one for each engine, one master and one lever to each group of three engines.

MODERN FRENCH DESIGNS

miles. Estimated bomb load is 7,800 lb.

Finally, mention should be made of an experimental high-altitude low wing monoplane at present still under development. No details of this type are available except that it has a pressure cabin for flights up to 49,000ft. and is equipped with two Hispano Suiza 12Z liquid-cooled 12-cylinder engines housed side by side in the fuselage nose and driving two contra-rotation airscrews. They are enclosed in a N.A.C.A. cowling, which also accommodates the coolant radiators. The fuselage, which accommodates a crew of five, is completely streamlined with only a transparent dome for the head of the pilot slightly projecting. The undercarriage retracts into the thick wing.

Civil Types

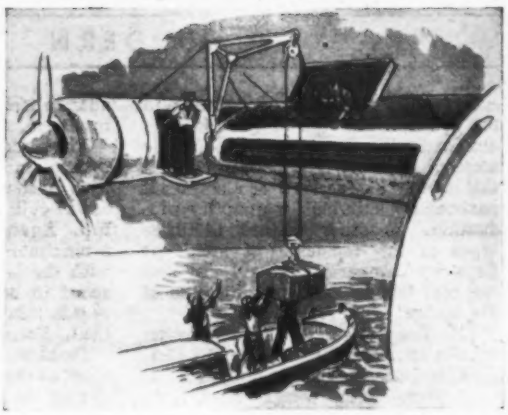
Reverting to civil types, some progress in the development of pre-war prototypes can be recorded.

The Bloch 161, a commercial transport aircraft, is designed to accommodate 33 passengers and a crew of five or six. The aircraft has an empty weight of 28,660 lb., and a disposable load of 19,840 lb. Wing area is 1,185 sq. ft., and wing loading approximately 41 lb./sq. ft. It is fitted with camber-changing flaps and powered with four Gnôme-Rhône 14N44 or 14N45 14-cylinder, twin-row radial engines of over 1,000 h.p. Some 25 machines of this type are reported to be in production at the S.N.C.A. du Midi works at Toulouse and the Dewoitine factory.

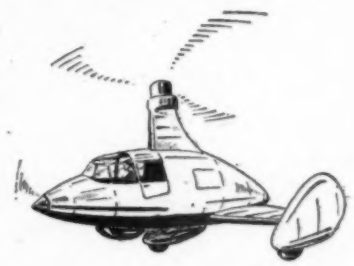
The S.N.C.A. du Sud-Ouest is engaged on the development of the following types:—

The SO-30N, a twin-engined commercial transport aircraft, accommodating 23 passengers and a crew of four. This is an all-metal mid-wing monoplane, featuring a cylindrically shaped fuselage with a pressure cabin, an undercarriage retracting into engine nacelles, and a twin-rudder unit. A pressure equivalent to that at 8,200ft. altitude will be maintained in the cabin by blowers designed to maintain this pressure up to 19,000ft. Wing area is 755 sq. ft., gross weight 26,500 lb., and wing loading 34.2 lb./sq. ft. The aircraft is powered with two Gnôme-Rhône 14N44 or 14N45 engines, and develops a cruising speed of 220 m.p.h., and a maximum speed of 300 m.p.h. at 19,700ft.

The SO-30R is a development of the above, accommodating 30 passengers,



Wing loading: Provision is made in the wing of the Latécoère 631 for the stowage of freight; a small detachable hoist is used for loading and unloading.

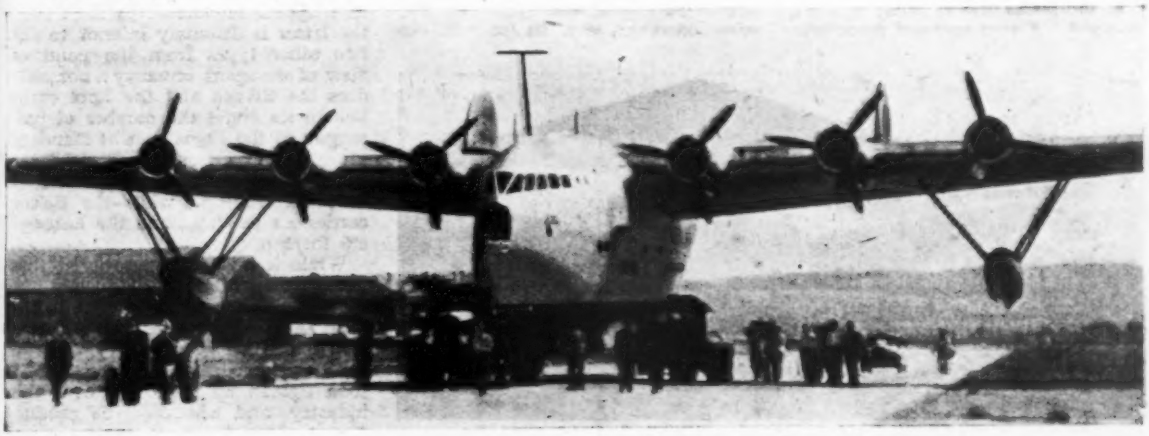


(Top) the S.E.700 Gyroplane. (Bottom) the Dewoitine D-520 single seater low-wing fighter.

and powered with Gnôme-Rhône 14R 14-cylinder, twin-row a.c. radial engines of 1,590 h.p. for take-off. The aircraft has a gross weight of 33,000 lb., a wing area of 883 sq. ft., wing loading of 39.5 lb./sq. ft., and power loading 4.67 lb./h.p.

The S.N.C.A. du Sud-Ouest has two further types in production: the SO-90 and the SO-91. Both aircraft are all-metal cantilever mid-wing monoplanes with twin-rudder units, and fitted with two supercharged Béarn 6-cylinder, air-cooled, in-line engines of 375 h.p. They have a useful load of 2,650 lb., including eight passengers. Camber-changing flaps, similar to those employed on the Westland Whirlwind, are to be provided for both types. Both types have identical dimensions and characteristics, namely, wing area 323 sq. ft., wing loading 28.1 lb./sq. ft., and power loading 12.1 lb./h.p. The only difference between the two types is the undercarriage, which on the SO-90 is of conventional design, and on the SO-91 is a tricycle type.

Marked in these designs of the S.N.C.A. du Sud-Ouest is the prefer-



Assembly completed: The S.E. 200 is one of the three flying boats recently constructed. It is powered with six Wright Cyclone 18-cyl. engines of 1,300 h.p. and can accommodate 70 passengers or 40 in sleeping berths.

MODERN FRENCH DESIGNS

ence for the mid-wing monoplane and the cylindrical shape of the fuselage, designed with a view to high-altitude employment. It is also claimed that this shape of fuselage renders itself particularly suitable for quantity production. Another feature of these types is the replacing of split-type flaps by camber-changing ones, and the care taken in the simplification of the cockpit equipment.

The Breguet-500 is yet another type in construction with the S.N.C.A. du Sud-Ouest. This is an all-metal monoplane with wings fitted with Breguet-type landing flaps, similar to Fowler flaps, and powered with two Gnôme-Rhône 14R 14-cylinder twin-row radials. The engines, fitted with two-speed superchargers, are rated at 1,220 h.p., and develop 1,600 h.p. for take-off. The Breguet-500 accommodates 23 passengers, has a cruising speed of 250 m.p.h. and a range of 1,250 miles.

Rotating Wing Aircraft

An interesting experimental type is the Gyroplane SE 700. This aircraft, which is under development by the same company as the types mentioned above, is of the tailless type, and features a pair of horizontal rigid control surfaces mounting vertical end-plates, and joined in a low-wing arrangement to the rear section of the fuselage. The rotor pylon is mounted on top of the fuselage centre and is faired to form an additional vertical fin. While the forward portion of the fuselage accommodates the cabin, the engine is placed in the rear section with an extension shaft to the tractor airscrew.

From information available, it appears that movable control surfaces have been eliminated, the control of the aircraft being effected by deflecting the rotor pivot and by the cyclic pitch variation of the rotor blade. The fixed undercarriage is mounted in the vertical end-plates and is partly enclosed by them. A semi-enclosed retractable nose wheel is mounted beneath the fuselage.

The aircraft has a height of 18ft., a rotor diameter of 41ft., and is powered with a Renault 220 h.p. or a Béarn 60 12-cylinder in-line engine of 330 h.p. Equipped with the former it has a maximum speed of 137 m.p.h., and with the latter 155 m.p.h. Minimum speed in horizontal flight is 25 to 27 m.p.h.; landing and take-off is vertical. Range 370 to 500 miles.

Perhaps the most striking development of the aircraft industry in France during the past two or three years has been in the construction of flying boats.

The first of these types is the Potez-Scan 161, built for the Vichy Government at S.N.C.A. du Nord (formerly *Potez-Scan—Chautiers Aero-Maritime de la Seine*). The six-engined flying boat has an all-up weight of 43 tons, and an empty weight, fully equipped, of 50,666 lb. It is interesting to note that on one of the early trials the aircraft flew with ten passengers and with a gross weight of 77,100 lb.

The aircraft has a span of 151ft., a length of 106ft., and a wing area of 2,850 sq. ft. Powered with six Hispano-Suiza 12Y liquid-cooled engines of 1,100 h.p. for take-off, it develops a cruising speed of 180 m.p.h., a maximum speed of 220 m.p.h., and has a range of 3,700 miles.

At the Latécoère Works near Toulouse the construction of the *Latécoère* 631 flying boat, on which 500 workers were engaged for 18 months, has been completed. This flying boat, a successor to a line of distinguished ancestors such as the Laté 521 *Lieutnant de Vaisseau Paris*, the Laté 300 *Croix du Sud*, is an all-metal monoplane with a cantilever wing and tail unit and retractable wing tip floats. The Laté 631 has an empty weight of 81,600 lb. and an all-up weight of 70 tons. Span is 188ft. 6in., length 154ft. 5in., wing area 3,770 sq. ft., wing loading 38.7 lb./sq. ft. to 40.9 lb./sq. ft., and power-loading 15.16 lb./h.p.

With a crew of seven, the aircraft has sitting accommodation for 40 passengers or 34 sleeping berths. Powered with six Wright Cyclone 14-cylinder, twin-row, air-cooled radials of 1,600 h.p. for take-off and driving v.p. Ratier airscrews, the maximum speed is 220 m.p.h., cruising speed 186 m.p.h., and the range 3,700 miles against a head wind of 37 m.p.h.

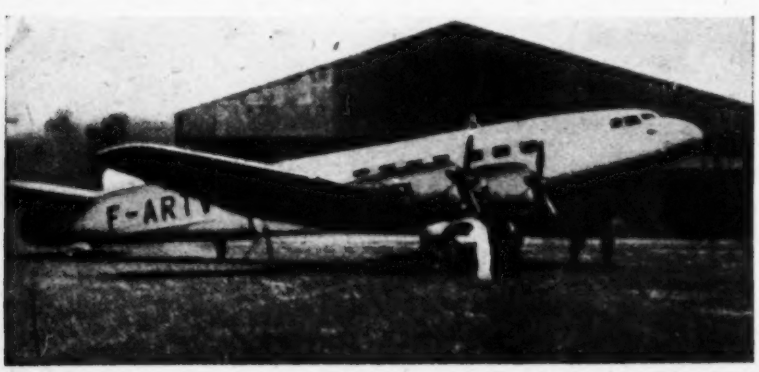
The internal layout of the Laté 631 features two decks, the upper one accommodating the pilot's cockpit, mechanics' station and the luggage compartment, and the lower deck with a central corridor, on both sides of which are six cabins each with two sleeping berths, bar, dining room, sanitary and cooking installations and, in the nose, a control room for alighting.

66-ton Boat

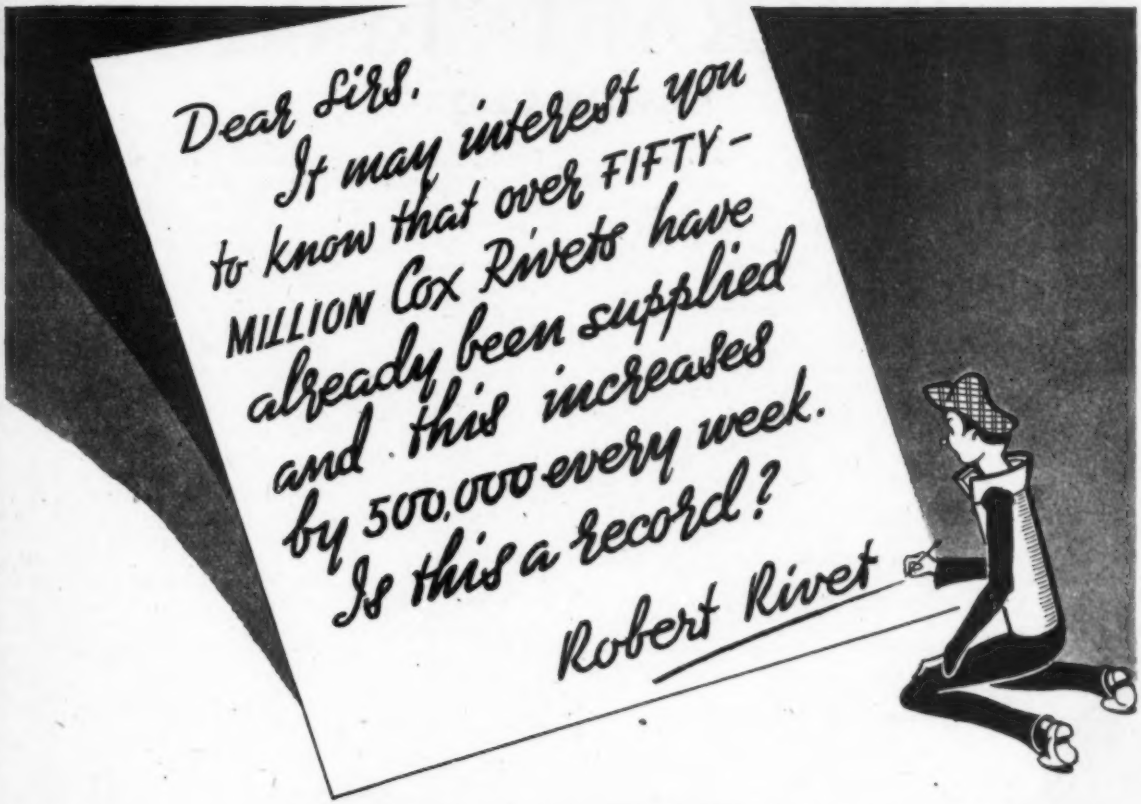
Finally, the third type, the SE 200 (previously Léo 49), a monocoque monoplane built by the S.N.C.A.S.E. at Marignane. The aircraft has the following dimensions: Span 170ft., length 134ft., wing area 3,650 sq. ft. All-up weight is 66 tons. Accommodation is provided for 70 sitting, or 40 sleeping passengers, for 1,100 lb. of mail, 440 lb. of general freight, and 5,200 lb. of luggage. Powered with six Wright Cyclone 18-cylinder, twin-row, air-cooled, radial engines of 1,300 h.p. each, the aircraft has a cruising speed of 186 m.p.h. and a top speed of 230 m.p.h.

A comparison of the three above types shows that the cruising speed of the Potez-Scan 161 is six m.p.h. slower than that of the other two aircraft. While each of the three aircraft has a range of 3,700 miles, the weight of fuel carried on board for that range differs considerably: the Potez does not require more than 27,300 lb., the SE 200 51,000 lb., and the Laté 631 44,000 lb. Although these figures may appear favourable to the Potez, the latter is definitely inferior to the two other types from the point of view of transport economy: not only does the SE 200 and the Laté carry five to six times the number of passengers as the Potez, but at standard range and at almost equal speed the Potez carries a commercial load of only 1.2 lb./h.p., while the SE200 carries 2.1 lb./h.p., and the Laté 631 2.6 lb./h.p.

While it must be appreciated that news of French air developments was rather sporadic and incomplete in the past, there is no doubt that in future it will become even scarcer. For it can be assumed that the Germans will soon tighten up their grip over this industry, and whenever the production is of no direct use for their war machine, it will be further throttled down or put out of existence.



For transport: The Bloch 161 is powered with four Gnôme-Rhône 14N44 twin-row engines of over 1,000 h.p. and accommodates 33 passengers and a crew of five.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Just in case you've not yet seen one, here is a sketch

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AIRCRAFT TYPES AND H

MACCHI C 202

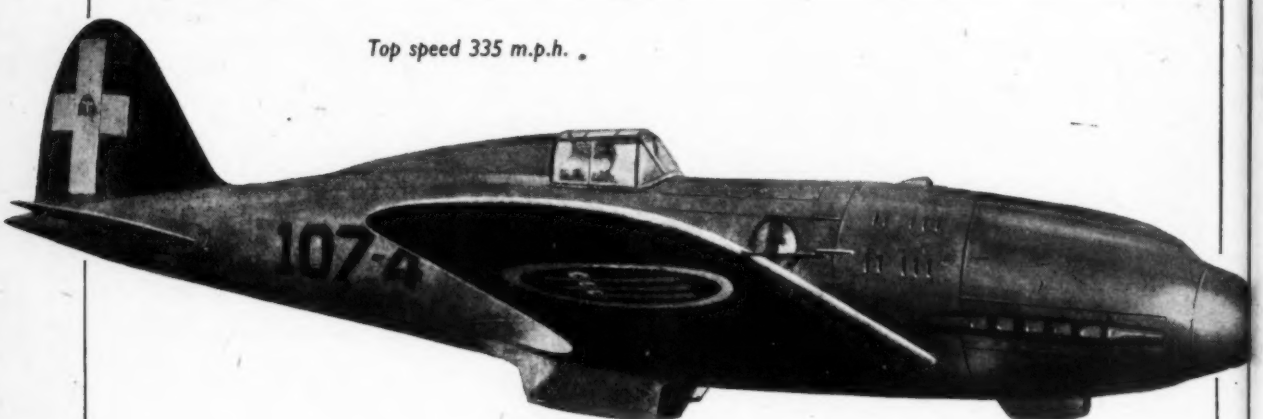
IN a way, the Macchi C 202 may be regarded as the Italian counterpart of our Supermarine Spitfire, though its performance is very much inferior to that of Britain's famous fighter. It is, in fact, only credited with a top speed of 335 m.p.h. at 18,000ft., which is no better than that of the early Hawker Hurricanes in the Battle of France. Nevertheless, it is the best the *Regia Aeronautica* can do in the way of single-seater fighters, and it resembles the Spitfire in having been developed from the earlier Macchi Castoldi racing aircraft, just as Mitchell's masterpiece was inspired by his Schneider Trophy seaplanes.

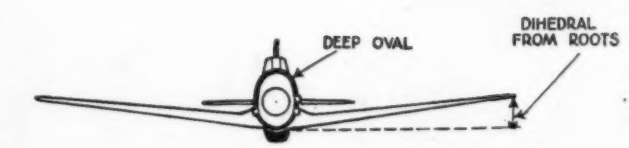
The C 202 is structurally similar to its immediate predecessor, the C 200, except that it has a Mercedes-Benz DB 601N engine instead of a Fiat air-cooled radial. The increase in horse-power from 850 h.p. to 1,200 h.p., and the improved streamlining of the fuselage by the use of a twelve-cylinder inverted "V" in-line engine, might have been expected to have brought about a really substantial increase in top speed, but, in point of fact, the C 202 is only just over 20 m.p.h. faster than the lower-powered Macchi with its "blunt-entry" nose.

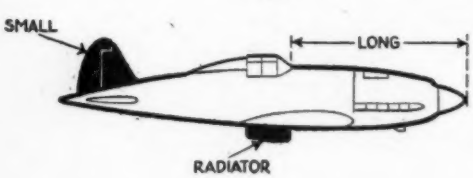
Aft of the nose, the fuselage, wings and tail-unit are the same as those of the C 200, but the cockpit cover is slightly different, being no longer transparent all round. This, plus the longer nose, which results in the pilot sitting amidships, can hardly have improved visibility either in the air or on the ground. The Macchi C 202 has been encountered by the R.A.F. and Allied Air Forces in considerable numbers over Egypt, Libya, Malta and the Mediterranean area generally, but it has proved no more successful in combat with our fighters than did its slightly slower predecessor. That extra 20 m.p.h. or so has, however, just given it enough speed to keep up with our medium and light bombers. Its cruising speed is a level 300 m.p.h. and its service ceiling 34,500ft.

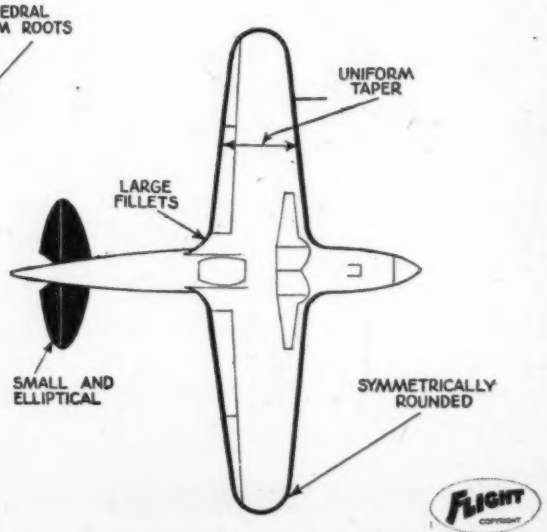
Its armament in no way compares with that of the modern British fighter, for it comprises either two synchronised 12.7 mm. machine guns mounted over the engine and firing through the airscrew disc, or, alternatively, four 0.300in. synchronised machine guns. All-metal, stressed-skin construction is employed, and, as on the C 200, the flaps and ailerons, which comprise the entire trailing-edge, are interconnected so that when the flaps are lowered, the ailerons also are dropped.

Top speed 335 m.p.h.









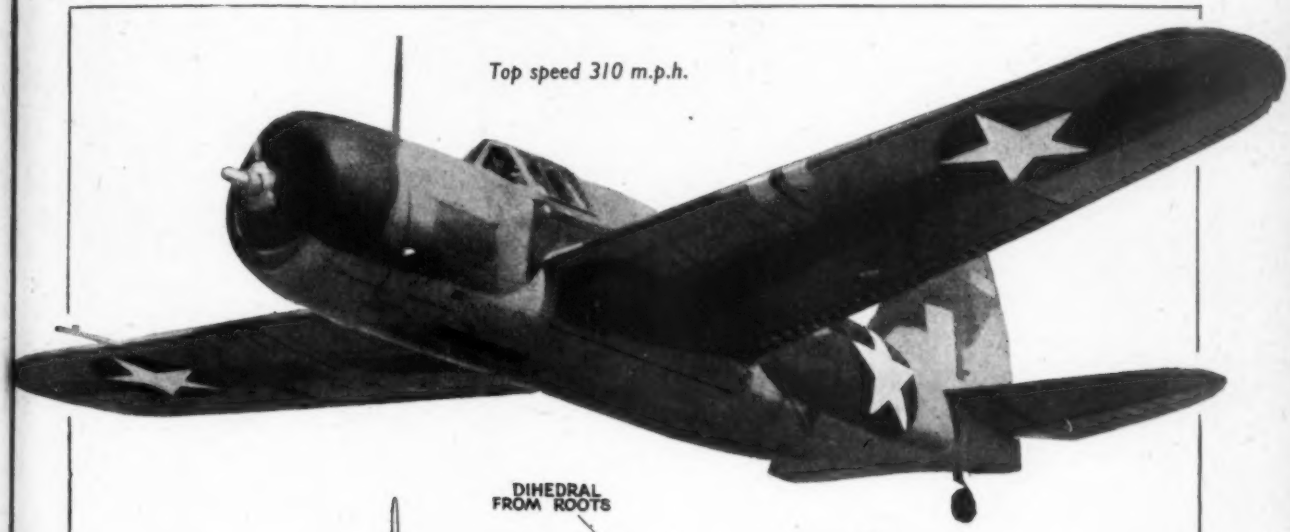
DIMENSIONS OF C 202

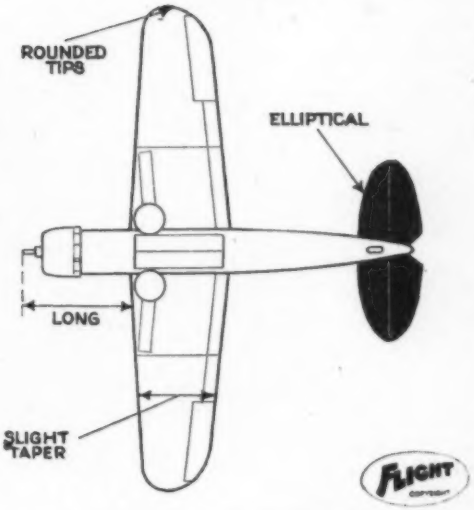
Span	*35ft.*
Length	*29ft. 6in.*
Height	*11ft. 6in.*
Wing Area	*180 sq. ft.*

FLIGHT COPYRIGHT

HEIR CHARACTERISTICS

BREWSTER BERMUDA





DIMENSIONS OF BERMUDA

Span	47ft.
Length	39ft. 6in.
Height	15ft. 3in.
Wing Area	370 sq. ft.

IN 1940, when the German Stukas did so much to blast a way for the advancing ground forces, the British Government decided it was high time we had some dive-bombers, and so ordered the Brewster 340, which it was decided to call the Bermuda. The delay of some two years in their delivery is an indication of how long it takes to get into actual quantity production even with a type that is already partially developed.

Of course, it was not realised in those desperate days of 1940 and later that the success of the German Stukas lay far more in the weakness of aerial opposition—which was often non-existent—than in any intrinsic qualities of their own. Since then it has been proved that against adequate fighter opposition the dive-bomber is easy meat indeed, and a most expensive way of using aircraft and their crews. Nevertheless, the dive-bomber with a reasonable performance (which means a considerably better one than that of the Junkers Ju 87) can, under the right conditions, be a most effective weapon. Even the Germans have now realised its limitations.

The production version of the Bermuda for the R.A.F. has undergone a number of changes which are important from the spotter's point of view. Chiefly, the gun-turret, originally located at the rear end of the cockpit cover, has been abandoned, presumably in favour of an ordinary gun-position, and the area of the fin has been increased by giving it a straight, sloping leading-edge that reaches much farther forward than did the curved outline of the original fin. The elliptical tailplane with the "bite" in the trailing-edge for rudder clearance remains the same, however, as do the slightly tapered, round-tipped wings of comparatively low aspect-ratio Perforated trailing-edge flaps act as dive brakes.

Substantially the same in general layout as the Bermuda, the U.S. Navy's version of the Brewster 340 dive-bomber is known officially as the SB2A-2, and goes by the name of the Buccaneer. The main differences are in its armament, details of which are not available for publication, and in various aspects of equipment peculiar to the respective Services.

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Its Importance in Relation to Air Power : Characteristics of Natural and Synthetic Varieties : Russian Experience

By V. L. GRUBERG

RUBBER is one of the strategic materials which form the basis of air power. Although it appears to be only of ancillary value in the aircraft industry, it is in fact no less important than those materials which are being used in larger quantities in every aircraft.

A glance at the drawing on this page will give a general idea of the wide and varied application of rubber in the construction of modern aircraft. Electrical insulation; handgrips; seat cushions; cowling supports; flexible ducts and connecting sleeves. All use rubber. It is used for the making of sealing rings and bellows; for tank supports and bullet- and leak-proof fuel and oil tanks; for packings for hydraulic mechanisms and oleo-struts, and for batteries.

Aircraft tyres consume substantial quantities of rubber. Instruments and delicate mechanisms are mounted on rubber to ensure their efficient operation; rubber mountings eliminate engine vibrations during flight. Finally, rubber is used for a great number of accessories, such as dinghies, gloves, high-altitude equipment and in the workshops of the aircraft industry.

The danger of ice formation has been largely eliminated by de-icers composed of rubber overshoes fitted to the leading edges of wing and tail surfaces. By operating a switch they automatically inflate and deflate, the pulsations cracking and dispersing the ice.

Small as the amount of rubber on a single aircraft may appear, the quantities used by the aircraft industry run into high figures. The tyres alone of 1,000 first-line aircraft absorb 85,000 lb. of rubber. For the full equipment of a bomber fleet of 1,000 machines about 1½ million pounds of rubber are necessary, and to go a step further, the personal equipment of 1,000 airmen, counting raincoats and gas masks only, requires some 4,500 lb. of rubber.

The problem of adequate rubber supplies is, therefore, no less important to the development of air power than it is in the equipment of armies or navies.

Prior to Japan's eruption in the Far East, the decisive share of the world's rubber resources was under the control of the United Nations. The Dutch East Indies, Malaya, Sarawak, and Borneo produced about 94 per cent. of the world's total output. The loss of these territories—if only temporary—has been a serious blow to the war effective of the Allies, since it left them with but few semi-developed rubber regions. British India, Ceylon and all Allied-

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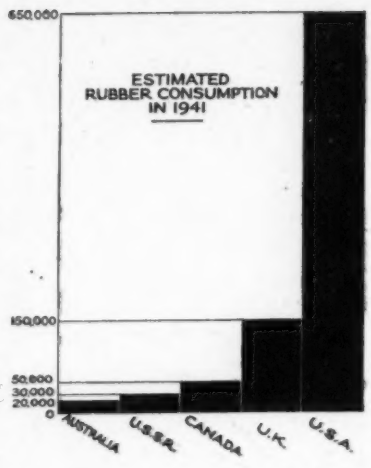
controlled territories in Africa accounted together in 1939 for about 100,000 tons of rubber, and the Latin-American countries for not more than 20,000 tons.

The crisis was aggravated by the fact that the care of the development of rubber resources outside the Pacific region was grossly neglected by the United Nations, either because of their complete reliance on the security of their Far East possessions, or because of the vast sums invested in rubber plantations.

In addition, until the Pacific rubber regions fell into Japanese hands, the financial interests controlling that industry appear to have adhered strictly to their old quota policy. To quote Mr. Jesse Jones, U.S. Secretary for Commerce, "apparently they did not want the quotas to be increased to such an extent that post-war markets would be seriously affected." This attitude is understood to have seriously delayed American attempts to build up stocks.



It is scarcely necessary to add that the situation so created was critical, and that ways and means had to be found to fill the gap in rubber supplies. The problem was, and to some extent still is, of such a magnitude that it cannot be readily solved. But some important progress has already been made, and further remedies are being developed.

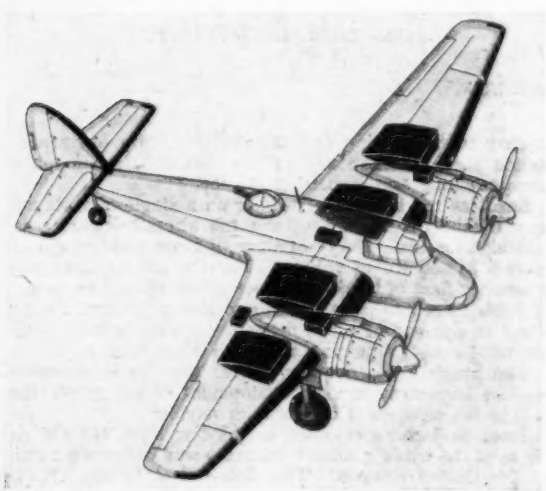
U.S. Reserves

In 1940, when the tension in the Pacific area had seriously increased, the U.S. Government had established a Rubber Reserve Company to take all measures necessary to preserve and accumulate rubber stocks. In April, 1941, the British Government appointed a Rubber Controller to husband the Empire's rubber resources. By the end of 1941 U.S. reserves were sufficient for 9½ months, or say, one year's consumption.

Rubber was placed on the critical list of strategic materials, and efforts to improve the situation were designed on the following lines: by reducing drastically non-essential civilian consumption; by regenerating salvaged rubber; by expanding existing synthetic production; and finally by husbanding natural rubber resources of the British Empire, of the Allied territories in Africa, and of the rubber resources of the American continent. Details of the tremendous undertaking are outside the scope of this article, but some information as affecting the immediate future is of interest.

Civilian consumption, both in this country and the U.S., was substantially cut down with the simultaneous increase in the use of regenerated rubber. In the U.S. alone this resulted in a saving of about 218,000 tons or three to four months' supply. Regenerated rubber has swiftly moved up from relative obscurity to an important place in the Allies' war potential. Although, even before the war, more use was made in the U.S. of regenerated rubber than in this country (where it amounted only to 7 per cent. of the total rubber consumption), the pace had to be further accelerated. Because of the low use of regenerated rubber before the war, large stocks of high-grade rubber salvage were in existence in this country, a fact of considerable importance to Britain's supply potential. In the U.S. 191,000 tons of regenerated rubber were produced in 1940 or about 30 per cent. of total consumption; in the following year the capacity of regenerating plants was about 270,000 tons per annum, and an American estimate, based on a 24-hour day and seven working days a week, suggested that it could be increased to 340,000 tons or half of the pre-war annual consumption.

The technical process of reclaiming is relatively simple, as illustrated by the following typical example: salvage rubber is fed into a grinding machine and ground to powderlike flour. This is then conveyed to digesters in which it is treated with caustic soda under high temperature and pressure to dissolve fibres, etc. The caustic soda is then washed away and the rubber powder subjected for 8 to 18 hours to a treatment with heat and steam pressure, to go afterwards to the mixing mill. There it is ground again, washed, dried and kneaded on steam-heated rolls. The emerging material, very much like dough, is then forced under steam pressure through a fine screen to clear any remaining foreign matter, and emerges from it looking like liquorice braid. The long strips of "liquorice braid" are then rolled and formed into slabs for the manufacture of different articles.



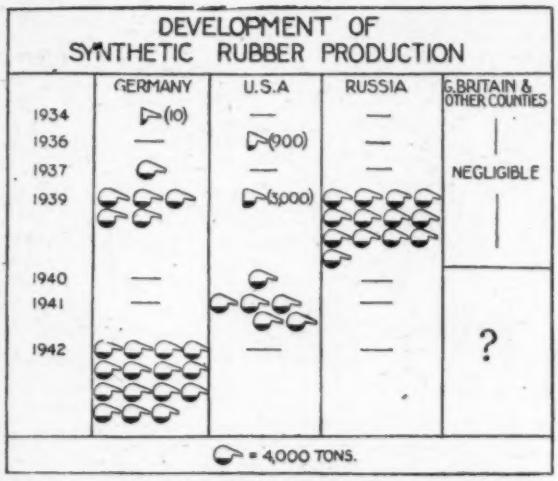
RUBBER GOES TO WAR: A general idea of the wide employment of rubber on a medium bomber. Parts on which all kinds of rubber are extensively used are in solid black.

Regenerated Quality

The quality of regenerated rubber depends largely on the quality of the salvage material and the process of regeneration. Since the salvaged article would normally contain a quantity of sulphur, carbon black, etc., added in the process of manufacture from crude rubber, the regenerated rubber is still contaminated with them. It has, in other words, a smaller proportion of crude rubber molecules, and while still having a certain amount of plasticity and softness, the resiliency is not fully restored. To obtain the best quality of regenerated rubber, salvage articles of high rubber contents are necessary. These are by no means common, since the bulky salvage is usually a composite mixture.

Broadly speaking, the quality of salvaged rubber is nowadays better than it used to be because it consists largely of rubber which has been protected by anti-oxidants, fortified with superior organic accelerators and of lower sulphur ratios.

On the average a ton of better grade scrap will produce three-quarters of a ton of reclaim. This proportion is important due to the increased volume of regenerated rubber used in a variety of articles. While it cannot be claimed that the regenerated product can altogether replace natural rubber for *all* uses, in the aircraft industry it can be advantageously employed in a great many articles. To



Britain and the U.S. relied before the war on supplies of natural rubber. Dashes on this diagram stand for unknown quantities, figures in brackets indicate tons.

mention only a few, aircraft tyres, protective covering, de-icers, hose, surfacing, etc.

It has been stated that salvage stocks available in the U.S. would yield 500,000 tons of reclaimed rubber per annum (or about 70 per cent. of the total consumption) for the next five years. But because of its physical properties not all articles can be produced from reclaimed rubber, and a certain amount of crude rubber is always necessary for the manufacture of the mixture. Moreover, the regeneration process cannot go on *ad infinitum*, and since existing supplies can only cover a part of the essential consumption, reclaimed rubber cannot be the only answer to the rubber riddle.

Natural Rubber Resources

For the last two years increased efforts have, therefore, been made to revive the natural rubber resources of the American continent, notably in Brazil, Mexico, Haiti and in California. In the last century Brazil was, in fact, the world's sole producer of rubber. But while in 1912 shipments of raw rubber from the Amazon Valley amounted to 45,000 tons, in 1938 Brazil and Mexico together produced only 15,000 tons. For in the meantime the centre of production had moved to the Far East, where scientific methods, favourable climate and cheap labour had established it firmly. South American plantations and wild resources have fallen into neglect and disuse. Yet even at present the Brazilian Foreign Secretary has estimated that there are 20,000,000 wild rubber trees in the Brazilian jungles.

For some years before the war, several American industrialists such as Ford, Firestone, and Goodrich, strove to make themselves independent of the Far East rubber supplies. In Costa Rica, in the Panama Canal Zone, in Fordlandia and Ford-Belterra in Brazil, in the Philippines and Haiti, millions were spent on creating a source of rubber supply for the American aircraft and automobile tyre industry.

Difficulties of securing adequate labour willing to work in the steaming jungles at wages competitive with coolie labour in the Far East have been mainly responsible for the lack of progress and a gradual frustration of these enterprises. With the impetus given by the war, and the energetic participation of the U.S. Government, substantial improvements in the material results of these efforts can be expected. Brazil's crop for the coming year is estimated to produce some 20,000 tons, and scientific leadership given by the U.S. Government in co-operation with several Latin-American countries may go a long way towards opening up other substantial rubber sources to meet the Allied Nations' need.

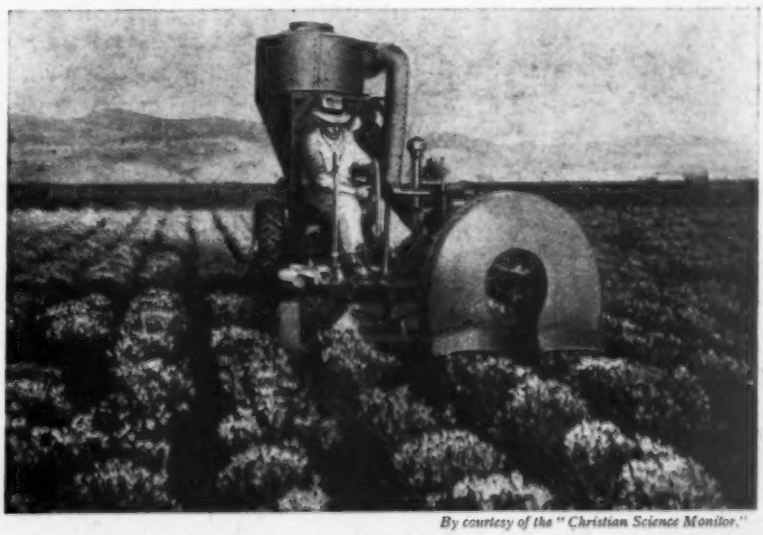
In Haiti the planned exploitation of the wild rubber trees has been started. This is expected to produce some 10,000 tons annually. Furthermore, large plantations have been revived and possibly developed, estimated to yield 30,000 tons yearly. These efforts are based on the "original" rubber tree, the *Hevea Brasiliensis*, which yields 450 to 1,300 lb. of rubber per acre and can be tapped a number of times a year. The quality of this rubber is in no way inferior to the Far Eastern rubber. The *Hevea* tree is tapped only in its seventh year, but its latex yield increases from year to year.

Varied Rubber Plants

Widely spread in Mexico is the *Castilloa* rubber tree, a native of that country, which was also planted at first in Malayan plantations. In the course of years the prodigious growth of *Castilloa* has rapidly declined, and intermittent speculation booms and depressions by private promoters did not improve the position. It is only now that the Mexican and U.S. authorities take a hand in a planned policy for the improvement and expansion of the existing wild and cultivated *Castilloa* trees.

Another important native of America is the *Guayale* shrub (pronounced *Gwá-yoo'-lá*), originating wild from the dry plateau of Central Mexico, and first discovered by Peter Carnahan in the early 1900s. This shrub has the advantage that it will grow on marginal lands and can be cultivated in different parts of the U.S., such as California, Mexico, Texas, Arizona, etc. Incidentally, Axis reports have recently stated that the plant is to be cultivated in Italy.

Domesticated *Guayale* shrub in California contains 23 per cent. of rubber and requires four years to mature. It yields in the fourth to fifth year about 1,500 lb. of rubber per acre, 2,000 lb. in the sixth year, reaching a peak yield in the seventh year. It can, however, be harvested after one year, but with reduced rubber yield. The disadvantage is that the plant has to be entirely dug out. It is then dried and crushed to extract the latex juice, much as cider



By courtesy of the "Christian Science Monitor."

THE VACUUM CLEANER: An ingenious American machine sucks in and collects seeds of *Guayale* shrub for further cultivation. The expansion of *Guayale* plantations has been mainly deterred by the shortage of seeds.

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is extracted from apples. The mashed material is then simply purified and the residue is rubber.

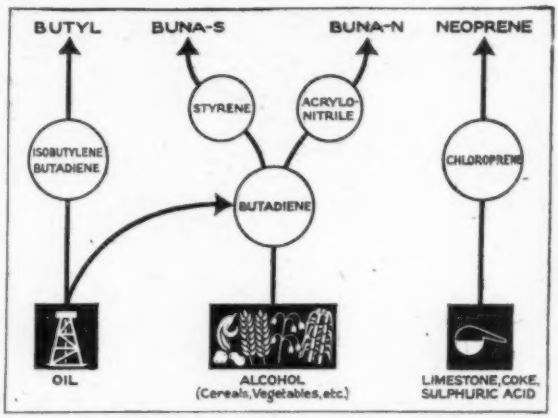
The quality of it differs, however, substantially from the usual *Hevea* rubber; it has a resin content of 18 to 20 per cent., as against 4 per cent. in tree rubber. Furthermore, and most important from the engineering application point of view, the best grades of *Guayale* rubber have a tensile strength of only two-thirds that of *Hevea* rubber. Thus what is gained in the short lapse of time before the first yield, is lost in quality. In the aircraft industry *Guayale* rubber is likely to find its application for compounding rubber mixtures of the necessary quality.

Guayale Yield

Between 1907 and 1912 this shrub, which then showed only 10 per cent. in rubber yield, contributed some 12 per cent. of the world's supply. At present it seems to be improving in its rubber yield and moving up to a significant position in the supply plan of the U.S. In the spring of 1942 45,000 acres were planted on an experimental station purchased by the U.S. Government at Salinas, California. By 1943 enough seeds are expected to be available to plant 456,000 acres, and since the shrub requires four years to mature the rubber yield in 1947 is estimated at 213,000 tons (!). Plans exist to expand the cultivation of *Guayale* in different parts of the United States as more seeds become available. The ultimate goal is one million acres, estimated to supply one-quarter of the total rubber consumption.

It has been estimated that if all wild-growing *Guayale* plants in Mexico were collected one could obtain 25,000 tons of rubber, but this would mean the loss of any further crops for a number of years.

To solve the rubber problem, the Russians have endeavoured to develop their synthetic production as well as to cultivate rubber-yielding plants. Between 1930 and 1931 about 1,000 wild-growing plants of Russia were carefully examined as to their contents of oils, fats, rubber, etc. In the course of these investigations a number of unknown plants were found, the roots of which contain rubber.



THE TRANSFORMATION: Synthetic rubber can be manufactured from a variety of basic materials, some of which exist in abundance in practically any country.

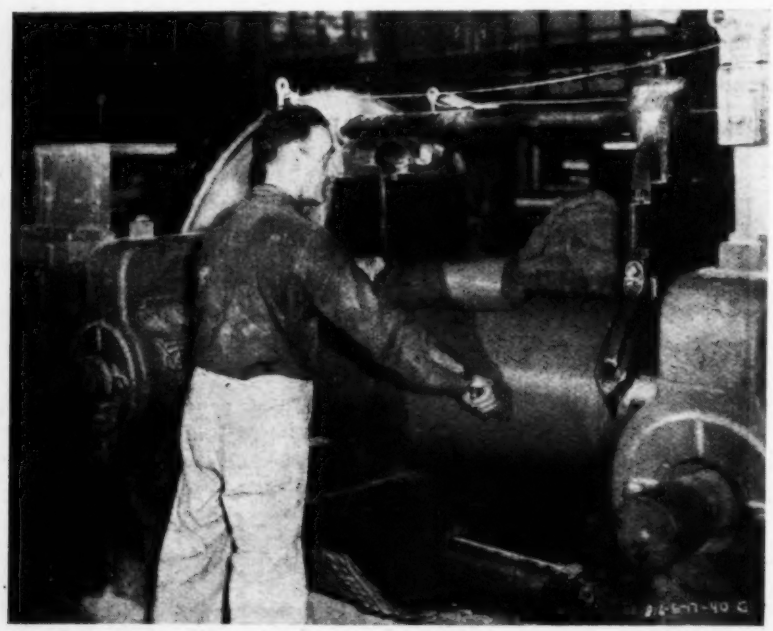
Of special interest were some dandelion species (*Teraxacum*), locally called by the Kirghise "sagys," found in Tianschan and in the Altai Mountains. Three "sagys" plants attracted particular attention: (1) the Kok-sagys; (2) Krim-sagys; and (3) Tau-sagys. After initial experiments it was found that Tau-sagys and Kok-sagys are a most promising source of rubber.

Russian Cultivation

The Russian experience in this field is indeed quite unique; the Ukraine, and White Russia, were found to be most suitable for cultivation, but the plant is so versatile that it grows successfully under a variety of climatic and soil conditions. In 1940 the area under cultivation in Russia was 320,000 acres; this was to be increased by 1942 to 1,250,000 acres. A number of plants for the manufacture of rubber from roots were established, and distribution centres and storage silos were organised.

According to Soviet reports, Kok-sagys harvested after one year produces 52 to 88 lb. of rubber per acre. In Latvia, where the Soviet Government had 2,500 acres planted with Kok-sagys in 1941, the yield was as high as 132 lb. per acre. The bi-annual Krim-sagys yields 88 to 160 lb. per acre, and the tri-annual Tau-sagys 154 lb. The Kok-sagys can be harvested after one year, but if it is left for another year it improves the rubber contents of its roots. The rubber yields of these plants are still liable to serious fluctuations, but, with the gradual improvement and standardisation of cultivation methods, even better results are expected.

Incidentally, the Germans have gained valuable experience from some Kok-sagys plantations in the occupied territories. While previously this source of rubber was a mystery to them, the Germans are now trying to lay out plantations on reclaimed moorlands in Hungary, Occupied Poland and Rumania. Since Kok-sagys succeeds best on drained moorlands, it may yet produce a by no means negligible contribution to Germany's rubber supply. That Germany is at present seeking to secure sources outside her synthetic production may be due to the inadequacy of the synthetic rubber output, to the shortage of



GETTING INTO SHAPE: Sheets of synthetic rubber emerge from these rolls which squeeze out any surplus liquid. The material is then compressed again into block-shaped cakes, ready for use by the rubber industry.

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industrial labour and to the insecurity of chemical plants and material production in face of R.A.F. raids. Consequently, there is a desire to form a rubber supply base in the strategic rear, based on cheap "native" labour.

The Americans also appear to be interested in this source of rubber, and in co-operation with the Russian Government steps have been taken to propagate the cultivation of Kok-sagys in a number of States. Since Kok-sagys is a hardy plant, thriving under different conditions and producing results relatively quickly, it might also be successfully taken on in this country for cultivation on moorlands and waste lands.

All these attempts to improve the rubber supply have one thing in common: they require time, in some cases years, before the results will be effectively felt. This is inherent in any cultivation and is not a criticism of the effort itself. Laws of nature cannot be altered by man, even if they can be in some ways modified to suit his purpose. The rubber problem is, however, not the problem of to-morrow, it is the problem of to-day. Important as a long-range policy may appear to certain future aspects of American economy, its practical contribution to the war effort should not be over-estimated.

It is clear that neither aircraft production nor the other branches of war industry can wait till 1947 for their rubber supplies. While at present they are not starved of rubber, the supplies must be ensured in order that a possible rubber bottle neck shall not strangle their constant expansion. And while all measures planned to husband every conceivable source of rubber in the Allied war effort help to avoid such a possibility, a radical and wider answer to the problem must be found if results are to follow in the shortest possible time. From this point of view a rapid expansion of synthetic rubber production appears to be of more immediate promise.

Synthetic rubber is derived from three main sources:—

(1) From some direct mineral source (petroleum or coal);
(2) From foodstuffs or potential foodstuffs (grain, maize, potatoes and starch-containing products generally), and
(3) From acetylene (indirect mineral source—coke and lime).

All synthetic rubbers have this in common that they are formed by polymerisation of small chemical entities. That is to say, by a process in which tiny molecules become grouped together to form one large rubber molecule or polymer, as it is called.

Synthetic Groups

Synthetic rubber is really not one but rather a range of materials, of chemical compositions different from those of natural rubber, but with similar physical and mechanical properties. Since it is these properties which are of main interest in the engineering application of synthetic rubber, one can classify the range into the following groups:—

The *Neoprene* group, which are polymers or copolymers of chloroprene.

Buna-S and Buna-N. The former are copolymers of butadiene (unsaturated hydro-carbon); the latter are copolymers of butadiene and acrylonitrile. They are oil and hydro-carbon solvent resistant to a high degree but poor in their resistance to oxygenated solvents. The Buna-S type is the most versatile of synthetic rubbers in the range of basic material from which it can be made and in its forms of application. The Buna-N type, although derived from the same source as Buna-S, has a more limited use and is not likely to be of great importance in the American expansion.

Butyl. a copolymer of isobutylene with butadiene, has high chemical stability and is very heat resistant and highly impermeable to gases.

In addition to the above four groups there exists at present three further groups of rubber-like materials:—

Thiocol is one of the oldest American synthetic materials. It is vulcanisable but the thermo-plasticity limits its employment to cases where elastic or other rubber-like properties are required at high temperatures. It has high resistance to oil and ageing, and is impermeable to gases.

Koroseal is a plasticised polyvinyl chloride. (A relatively hard resin rendered more pliable by the admixture of plasticisers.)

Vistanex polymers of isobutylene (polybutylene).

In applications in the aircraft industry the qualities of synthetic rubbers are of special importance. They all show a good resistance to ageing. Their great resistance to organic solvents and different oil derivatives makes them particularly suitable for glands and seals in hydraulic systems where mineral oil is used, and wherever there is contact with lubricants, petrol or anti-freeze liquids. Moreover, it is possible to select the kind of synthetic material which is specially suitable to the required application.

For high-altitude flying equipment, resistance to the effects of sunlight and cold is essential. The neoprene types have excellent resistance to the deteriorating influence of sunlight, while other types of synthetic rubber can be compounded to be serviceable at temperatures as low as −70 deg. F.

Heat Resisting Groups

No less important are the excellent heat-resisting properties of the Buna and Neoprene rubbers. Finally, Neoprene is non-inflammable and is less permeable to gases, hydrogen permeability being only one-third of that of natural rubber.

Thus the outstanding qualities of synthetic rubbers can be summed up under the following headings:—

(1) Oil resistance;
(2) Resistance to heat;
(3) Resistance to deteriorating by exposure to light, and oxygen;
(4) Resistance to gas diffusion.

It should be noted that by way of a compromise between the properties peculiar to different types of synthetic rubber, it is possible to obtain a combination of these properties by suitable mixing with either natural rubber or different plastic materials. In this manner a rubber can be obtained with qualities exactly suitable for the required purpose.

It is clear from the above brief indication of the qualities of synthetic rubber that its application in the aircraft industry offers great possibilities and is steadily increasing. There is indeed no justification for the still commonplace attitude towards synthetic rubber, which one correspondent in *Flight* rightly called "superiority delusions."

In Russia, where the production of synthetic rubber was tackled no less energetically than in Germany, grain was the most important source of alcohol as a basic material for S.K.A. synthetic rubber. Later, potatoes were utilised and a network of small starch factories was organised on collective farms. Another Russian product, the S.K.B., was produced from butadiene from petroleum; in the "Sovprene" synthetic rubber acetylene is the basic material.

The pictorial graph showing the comparative development of synthetic rubber production in Russia, Germany, U.S.A. and Great Britain bears out the contention that this industry has been neglected, both in this country and in the U.S. With the loss of the main sources of supply of natural rubber, however, a rubber production basis for the Allied war effort has been set up in the U.S.; resources of essential materials necessary for the synthetic production are larger there than in this country.

In the spring of 1941 plans were adopted for "shadow" factories estimated to produce 10,000 tons of Buna-S per annum. A further U.S. plan for 1943-4 foresaw the production of 800,000 tons of synthetic rubber, composed of 87.5 per cent. of Buna-S, 5 per cent. of Neoprene and 7.5 per cent. of Butyl. It is estimated that by 1944 the

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output of U.S. synthetic rubber will reach over 1,000,000 tons.

This production is to be based on the chemical industry, notably the Carbide and Carbon Co.; the Celanese Corp. of America; the Monsanto Chemical Co.; the Dow Chemical Co.; Du Pont de Nemours & Co.; on the "Big Four" of the tyre industry: Firestone, Goodrich, Goodyear and U.S. Rubber; and on the oil companies: Standard Oil; Texas Corp.; Pure Oil; Shell; Sinclair; Atlantic; Refining Gulf Oil, and Cities Service.

Incidentally, the Standard Oil Company is reported to have developed a process by which the raw material for Buna-S and butyl rubber becomes, so to speak, a by-product of aviation fuel production.

A further source from which rubber will be made is grain. In comparing the two possibilities, rubber-from-alcohol and rubber-from-petroleum, it has been stated that while the extensive production of alcohol from grain has the advantage of cheaper construction of plants, cheaper raw material, less steel, one-third of the time necessary to complete a rubber-from-oil plant, the difficulties are not negligible.

Fifty per cent. of the American distilling industry are reported to have been already converted, and some months ago the W.P.B. announced that practically the entire distilling industry is being switched over from liquor to alcohol manufacture. All alcohol not needed for explosives is to go into butadiene. If one visualises the capacity of the British distilling industry manufacturing liquor, one can understand what possibilities exist for the production of synthetic rubber.

According to American estimates, the military requirements in rubber by January 1st, 1944, will amount to 842,000 tons, of which natural and reclaimed rubber should produce 631,000 tons. The balance is to be covered from synthetic production.

Whether these figures will materialise or not is less important than the fact that a growing share in the Allied rubber supply will fall to the synthetic industry. And since rubber-from-alcohol is taking an increasing part in this production, the following few details may be of interest.

According to Russian information, out of 1 ton of alcohol 310 lb. of rubber were produced in 1934, 510 lb. in 1935, and 720 lb. in the subsequent years. An acre of grain yielded 308 lb. of alcohol, while more than ten times this amount was obtainable from the same area of potatoes. American data state that one acre of potatoes yields 660 lb. of rubber. Moreover, with each ton of rubber important by-products are obtained.

Worker Output

In rubber plantations, on the other hand, one acre of land grows 160 rubber trees, and yields about 320 lb. of rubber a year. Furthermore, while on plantations one worker produces on an average 2.2 lb. of rubber per day, in the synthetic factory his daily output is 44 lb. Thus, given the plant capacity and necessary basic material, the 200,000 tons of synthetic rubber to cover the military requirements quota would represent roughly one year's output of a labour force of 30,000.

To tide over the period necessary for the American synthetic industry to reach its full production, all efforts are being made to increase the output of the Empire rubber resources. In the first quarter of 1942, Ceylon's rubber plantations yielded 35,000 tons, or double the amount of the corresponding period in 1941. According to experts, this production can be further increased immediately by 30 to 50 per cent. without harming the trees. India is taking an increasing share in these efforts, and according to reports from New Delhi, a Rubber Production Board is being set up there. French Central Africa is to supply over 4,000 tons of rubber, and Liberia 10,000 tons.

With the vast agricultural and chemical resources of the United Nations being geared up to the maximum, and bearing in mind the stringent measures to eliminate all non-essential consumption, the danger of a rubber crisis is gradually subsiding.

Five Hundred in 1942

FIGHTER COMMAND'S No. 11 Group scored its 500th victory of 1942 without the victor firing a shot. Spitfires from the Group were providing fighter cover for returning Fortresses which had bombed Rouen in daylight when Pilot Officer B. J. Hull, D.F.M., of the Baroda Squadron, sighted a Fw 190 and bore down on it. The enemy aircraft promptly went into a steep dive.

"I followed it for several thousand feet," P/O Hull said afterwards, "and we were soon tearing down at about 400 miles an hour. I imagine the Hun pilot 'blacked-out' before he could pull out of the dive, for his aircraft went straight into the water. I did not fire my guns."

On this operation the Baroda Squadron accounted for three enemy aircraft in under five minutes. Victory No. 498 for the Group was scored by Flt. Lt. W. Gregson, D.F.C. He became separated from the remainder of the Squadron and found himself involved with about ten Fw 190s, which were trying to attack the Fortresses. He shot one down into the sea, and was then joined by other members of his Squadron.

No. 499 fell about two minutes later to Flt. Lt. M. P. Kilburn, D.F.C., who commands the Squadron's other flight. His victim exploded in mid-air. Then came P/O. Hull's attack which is recounted above. These and other engagements all happened within such a short space of time that it was only about a week after the event—when claims had been sorted out and time checked—it was possible to determine that P/O. Hull's victory was the third in the engagement and thus the 500th victory of the year.

Air Vice-Marshal H. W. L. Saunders, Air Officer Commanding No. 11 Group, Fighter Command, with his Senior Air Staff Officer, Air Comdre. G. Harcourt-Smith.

Aircraft of the Anglo-American Forces

Review of British and U.S. Types in Operational Service

THE complete list to be published will run to some 70 different types of aircraft of British and American manufacture and will embrace the whole of the operational range from transport to the heaviest bomber and the latest fighter on which information may be published. Trainers, however, will not be included. Some of these aircraft, of course, exist in slightly varying forms and under different names according to the Service by which they are employed. For example, the military version of the Douglas DC-3 is known in the American Army as the C-47, but is in service with the R.A.F. as the Dakota. The Douglas dive-bomber, known to the R.A.F. as the Dauntless, is also in service with the U.S. Army as the A-24 and with the U.S. Navy as the SBD-1, -2, and -3. Our Fleet Air Arm call the Grumman F4F fighter the Martlet, but the same machine, with the necessary modifications, becomes the U.S. Navy's Wildcat.

In all such cases, the aircraft will be listed under whichever name *comes first in alphabetical order, its other names and American symbols being given in the adjacent text. Thus the Grumman F4F will be listed as the Martlet and the U.S. Navy title of Wildcat given in the text. The Douglas Dauntless will be listed under this name with A-24 and SBD mentioned in the text, and so on.*

The biggest single class will be found to be the fighters, numbering some 20 different types, followed by 12 to 15 bombers, both two- and four-engined. The balance will comprise some half-dozen or so each of dive-bombers, torpedo-carrying aircraft, reconnaissance, observation-scouting and T.S.R. types, and flying-boats ranging from the Walrus of the Fleet Air Arm to the experimental Martin Mars of the U.S. Navy.

AIRACOBRA

BELL AIRCRAFT CORP., U.S.A. Single-seater fighter in service with the U.S. Army and the R.A.F. Low-wing monoplane with one 1,150 h.p. Allison 12-cyl. liquid-cooled "V" type engine mounted amidships and driving the airscrew via an extension shaft to reduction gear in the nose. Engine, cockpit and reduction gear are all carried in one rigid cradle-frame, which forms the main fuselage component. Car-type door to pilot's cockpit; tricycle undercarriage. One cannon firing through airscrew hub, two m.g.s in fuselage and four in wings. Dimensions: Span, 34ft.; length, 29ft. 9in.; height, 9ft. 3in.; wing area, 213 sq. ft. Performance: Top speed, 358 m.p.h.; cruising speed, 335 m.p.h.; service ceiling, 35,000ft.; range, 1,098 miles.

ALBACORE

FAIREY AVIATION CO., Gt. Britain. Two-three-seater T.S.R. biplane in service with the Fleet Air Arm, intended as an "interim" replacement type and to supplement the Swordfish on aircraft carriers. Folding wings for carrier stowage. One 1,065 h.p. Bristol Taurus sleeve-valve, radial air-cooled engine. Enclosed cockpits, the pilot being in a high position forward of the wings, where he has the best possible view for deck flying; when carrying torpedo, crew consists of pilot and gunner only; at other times there is pilot, observer and telegraphist-gunner. Apart from its 18in. torpedo, no armament details, nor performance figures, have been released for publication. Dimensions: Span, 50ft.; length, 39ft. 10in. (floatplane, 42ft. 6in.); height, 17ft. 9in.

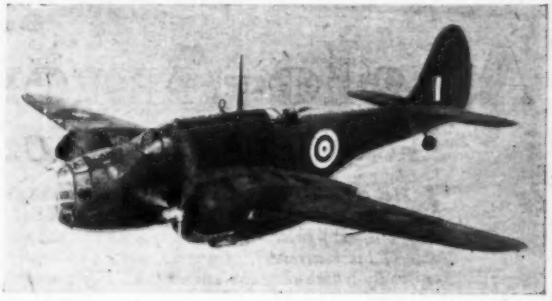
AVENGER

GRUMMAN AIRCRAFT ENGINEERING CORP., U.S.A. Two-three-seater torpedo-bomber in service with the U.S. Navy. Mid-wing monoplane with one 1,600 h.p. Wright Double Cyclone air-cooled radial engine. It carries one 21in. torpedo completely enclosed in its belly, or, alternatively, a 2,000-lb. bomb load. Little official information is available, but its armament is believed to consist of two m.g.s firing from troughs in the cowling, two m.g.s in the bubble turret at the rear of the cockpits and a single manually operated m.g. in the gun position under the tail. Estimated performance figures are: Top speed, 270 m.p.h.; cruising speed, 215 m.p.h.; service ceiling over 20,000ft.; range, 1,400 miles. Dimensions: Span, approximately 53ft.; length, approximately 37ft.

AIRCRAFT OF THE ANGLO-AMERICAN FORCES

BALTIMORE

GLENN L. MARTIN CO., U.S.A. Mid-wing medium bomber, with crew of four, in service with the U.S. Army and the R.A.F. Powered by two 1,600 h.p. Wright double-row Cyclone air-cooled radial engines. Notable feature is its all-plastic nose, even the ribs being of the same transparent material. Its bomb load varies from 1,000 lb. to 2,000 lb., according to operational requirements, and it has a heavy defensive armament consisting of eight m.g.s in the wings and fired by the pilot, two in the dorsal turret and one, manually operated, firing through the entrance panels in the floor aft of the trailing-edge. No performance figures have yet been made available. Dimensions: Span, 61ft. 4in.; length, 48ft. 6in.; height, 17ft. 9in.; wing area. 538.5 sq. ft.

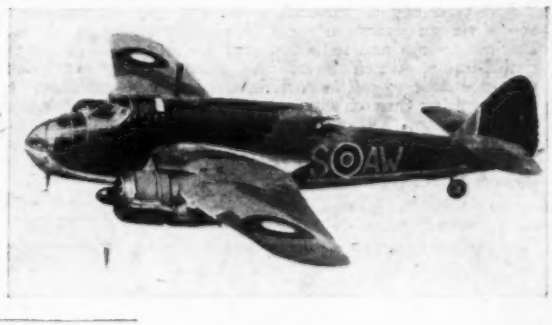


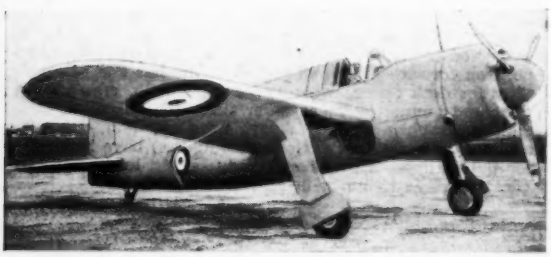
BEAUFIGHTER

BRISTOL AEROLANE CO., Gt. Britain.—Mid-wing, two-seater, twin-engined day and night fighter, in service with the R.A.F. Powered by two 1,400 h.p. Bristol Hercules III two-row sleeve-valve air-cooled radial engines. Another version, the Beaufighter II, has Rolls-Royce Merlin engines. When used as a night fighter, the finish is all black. Its armament comprises four 20mm. cannon in the fuselage nose and six .303in. m.g.s in the wings; four are mounted in the starboard wing and two in the port wing, which also has to accommodate the landing light. Performance: Top speed, 330 m.p.h.; cruising speed, 200 m.p.h.; service ceiling, 28,900ft.; range, 1,500 miles. (No performance figures are available for the Merlin-engined version.) Dimensions: Span, 57ft. 10in.; length, 41ft. 4in.; height, 15ft. 10in.; wing area, 503 sq. ft.

BEAUFORT

BRISTOL AEROPLANE CO., Gt. Britain.—Mid-wing torpedo-bomber with crew of four, in service with the R.A.F. and R.A.A.F. Fitted with two 1,065h.p. Bristol Taurus two-row, sleeve-valve air-cooled radial engines. The Beaufort has an admirable "pay-load," and has been proved equally efficient at reconnaissance, bombing and torpedo carrying. Its 18in. torpedo is partially enclosed within the bomb bay, and its defensive armament comprises four m.g.s in the wings and two in the nose, and another pair in the power-operated turret amidships. The only official performance figures available mention a top speed "in excess of 300 m.p.h.," and an operating range of nearly 2,000 miles. Dimensions: Span, 57ft. 10in.; length, 44ft. 2in.; height, 14ft. 3in.; wing area, 503 sq. in.



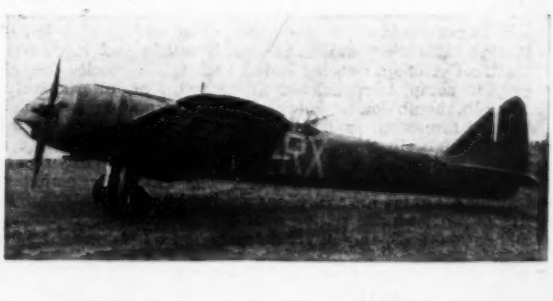


BERMUDA

BREWSTER AERONAUTICAL CORP., U.S.A. Two-seater scout dive-bomber in service with the U.S. Navy under the name of the Buccaneer and numbered SB2A. It has also been ordered for the R.A.F. and Fleet Air Arm. The maker's designation is Brewster 340. It is powered by a Wright double-row Cyclone GR-2600 air-cooled radial engine of 1,600 h.p., and the production version differs from the original Bermuda in having no gun turret and a triangular fin instead of a curved one. A top speed of just over 300 m.p.h. is reported, but no other performance or armament details are yet available for publication. Dimensions: Span 47ft., length 39ft. 6in., height 15ft. 3in.

BLENHEIM I AND IF

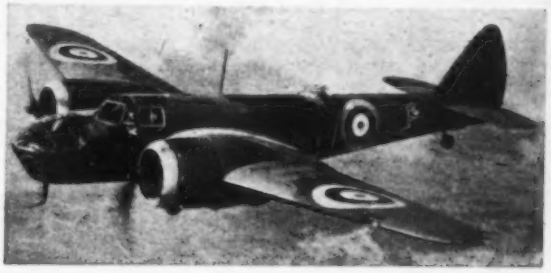
BRISTOL AEROPLANE CO., Gt. Britain. Mid-wing bomber and long-range fighter respectively in service with the R.A.F. Normal crew of three; original "short-nosed" Blenheim had only one forward gun in the port wing and two in the Bristol retractable dorsal turret. The IF had its armament increased by the addition of four fixed forward-firing m.g.s in a mounting which projected below the fuselage. Powered by two 920 h.p. Bristol Mercury XV nine-cylinder air-cooled radial engines, giving a top speed of 285 m.p.h. at 15,000ft. Service ceiling 27,280ft., range at 220 m.p.h. with full load 1,125 miles. Dimensions: Span 56ft. 4in., length 30ft. 9in., height 9ft. 10in., wing area 469 sq. ft.

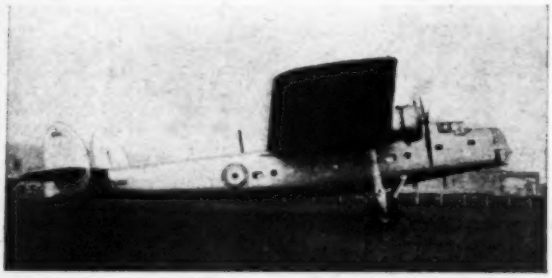


AIRCRAFT OF THE ANGLO-AMERICAN FORCES

BLENHEIM IV

BRISTOL AEROPLANE CO., Gt. Britain. The Mk IV is a "long-nosed" development of the Mk I, the nose having been lengthened by some 3ft. to provide better navigation and bomb-aiming facilities. It also has additional tanks in the wings which increases the range to approximately 1,900 miles. One of the most useful aircraft in the R.A.F., there are also IVF and IVL variations. The armament is similar to that of the short-nosed Blenheim but with the addition of remotely controlled rearward-firing guns in a blister under the nose. Top speed is stepped up to 295 m.p.h. at 15,000ft., otherwise performance is approximately the same as that of the Blenheim I. Dimensions are also the same except that the length is increased to 42ft. 9in.



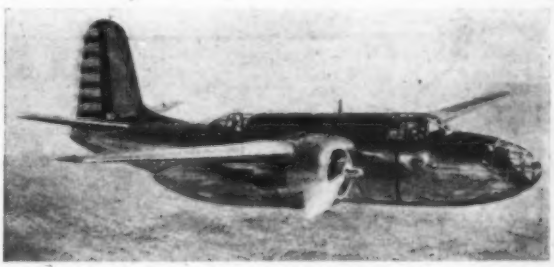


BOMBAY

BRISTOL AEROPLANE CO., Gt. Britain. Twin-engined, high-wing transport in service with the R.A.F. Powered by two Bristol Pegasus XXII nine-cylinder radial engines rated at 890 h.p. at 6,500ft. and a maximum of 1,010 h.p. for take-off. It was originally designed as a bomber-transport. It is particularly well armed for a transport, having enclosed gun turrets in nose and tail. The wide, fixed undercarriage has its oleo legs attached beneath the engine nacelles and the wheels are generally equipped with streamlined fairings. Top speed 192 m.p.h., cruising speed 160 m.p.h. at 10,000ft., service ceiling 25,000ft., maximum range with auxiliary tanks 2,230 miles. Dimensions: Span 95ft. 9in., length 69ft. 3in., height 19ft. 6in., wing area 1,340 sq. ft.

BOSTON III AND HAVOC II

DOUGLAS AIRCRAFT CO., U.S.A. Twin-engined, high-wing medium bomber in service wth the R.A.F. and, with certain modifications, with the U.S. Army as the A-20A. The R.A.F. night-fighter version is known as the Havoc II. Two Wright double-row Cyclone 14-cyclinder GR-2600-A5B air-cooled radial engines power the R.A.F. versions (the DB-7B), but the A-20A has R-2600-A71 Cyclone engines with exhaust-driven turbo-superchargers. Boston III armament comprises six machine guns in all. A bomb load up to 2,000 lb. can be carried. The Havoc II has a battery of machine guns concentrated in the nose. Top speed is 350 m.p.h. at 12,000ft. Dimensions: Span 61ft. 4in., length (Boston III) 47ft. 4in., (Havoc II) 49ft. 8in., height 18ft., wing area 465 sq. ft.



BUFFALO

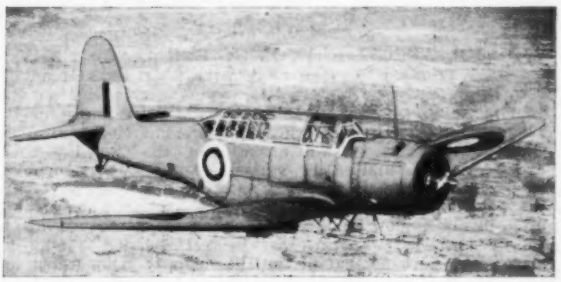
BREWSTER AERONAUTICAL CORP., U.S.A. Mid-wing single-seater fighter in service with the R.A.F. and U.S. Navy under the designation F2A-2. Powered by one 850 h.p. Wright Cyclone nine-cylinder air-cooled radial engine, developing 1,000 h.p. at 13,500ft. The U.S. Navy version has four 0.50in. m.g.s, two in the fuselage decking firing through the airscrew disc and one in each wing outside the airscrew disc, all fired electrically. There is also provision for two 100 lb. bombs, one under each wing. R.A.F. Buffalo fighters in the Far East probably have 0.303 m.g.s and more of them. Top speed is 337 m.p.h. at 15,000ft., service ceiling 30,650ft., and maximum range 1,426 miles. Dimensions: Span 30ft., length 25ft. 8in., height 12ft. 1in., wing area 209 sq. ft.

CATALINA III

CONSOLIDATED AIRCRAFT CORPORATION, U.S.A. Pedestal-wing, twin-engined amphibian flying boat in service with Coastal Command, R.A.F. and U.S. Navy as the Cansos, or PBY-5A. Two 1,200 h.p. Pratt and Whitney Twin Wasp air-cooled radial engines are fitted on the leading-edge of the centre-section; Curtiss electrically operated, reversible-pitch c.s. airscrews are employed. Distinctive feature of the armament is the provision of two large gun-blisters, one on each flank of the hull, aft of the wings, each of which accommodates a pair of Browning machine-guns. Stabilising floats retract to form wing-tips. Tricycle-type retracting land wheels. Top speed 190 m.p.h., service ceiling 25,200ft., maximum range 4,000 miles. Dimensions: Span 104ft., length 65ft. 2in., height 18ft. 6in., wing area 1,400 sq. ft.

AIRCRAFT OF THE ANGLO-AMERICAN FORCES

CHESAPEAKE

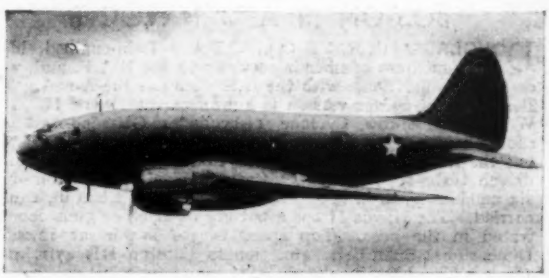


VOUGHT-SIKORSKY AIRCRAFT DIVISION OF THE UNITED AIRCRAFT CORP., U.S.A. Two-seater Fleet dive-bomber, in service with the Fleet Air Arm and the U.S. Navy as the SB2U, the latest modification of which, the SB2U-3, bears the name Vindicator. An all-metal low-wing monoplane powered by a single 750 h.p. Pratt and Whitney Twin Wasp Junior. Was taken over in 1940 as the residue of a French contract. Can carry a bomb load of 1,500 lb. externally, and may be fitted with an auxiliary fuel tank below centre-section. Four m.g.s in the wings and one in rear cockpit. Top speed, 257 m.p.h.; service ceiling, 28,200ft.; maximum range, 700 miles. Dimensions: Span 42ft., length 34ft., height 9ft. 10in., wing area 305.3 sq. ft.

CLEVELAND

CURTISS-WRIGHT CORPORATION, U.S.A. Two-seater scout-bomber biplane, in service with the R.A.F. just after Dunkirk, some still with French markings until repainted. A few are possibly still in service in the Far East. A later model, the SBC-4, remained in service with the U.S. Navy, but is being replaced by the SB2C-1, their new Helldiver. The Cleveland is powered by one 850 h.p. Wright Cyclone nine-cylinder air-cooled radial engine (R-1820-34) and has a top speed of 235 m.p.h., a cruising speed of 176 m.p.h., a service ceiling of 24,500ft. and a maximum range of 855 miles. Light bombs are carried in external wing racks. Usual armament is one synchronised m.g. above the fuselage for the pilot and one in the observer's cockpit. Dimensions: Span 34ft., length 27ft. 5in., height 10ft. 3in.

COMMANDO

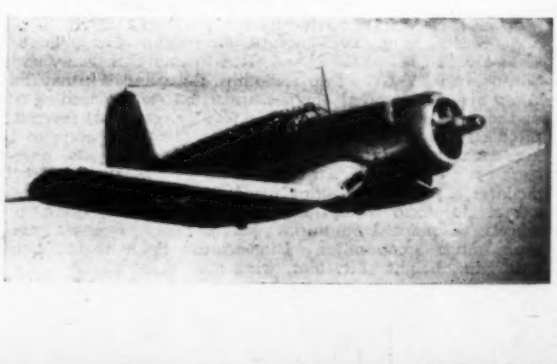


CURTISS-WRIGHT CORPORATION, U.S.A. Twin-engined transport and troop-carrier, in service with the U.S. Army Air Force. A development of the CW-20 civilian airliner, the prototype of which was built as an experimental sub-stratosphere aircraft with provision for a pressure-cabin, the Commando, or C-46, now has Pratt and Whitney engines of as yet unrevealed type, but they are probably the 2,000 h.p. 18-cylinder Twin Wasp type. In any case, it is the largest twin-engined aircraft in the world, with a reputed gross weight of more than 50,000 lb. As a troop-carrier it can accommodate forty fully armed and equipped men. Dimensions: Span 108ft., length 76ft. 4in., height 22ft., wing area 1,360 sq. ft.

CORONADO

CONSOLIDATED AIRCRAFT CORPORATION, U.S.A. Four-engined patrol flying boat in service with U.S. Navy, with official designation of PB2Y-2. Powered by four Pratt and Whitney Twin Wasp R-1830-SIC3-G air-cooled radial engines, each of 1,200 h.p., and fitted with three-bladed Hamilton-Standard hydromatic, fully feathering airscrews. Three gun turrets in nose, tail and amidships over trailing-edge of wings. Roomy living and sleeping accommodation is provided for the crew, and the galley has an electric cooking range and a refrigerator. There is also a workshop and an independent electric generating system which supplies current throughout the boat; heating and ventilating systems. Stabilising floats retract to form wing tips. Twin tail has dihedral angle. Dimensions: Span 115ft., length 79ft. 3in., height 25ft. 4in., wing area 1,780 sq. ft.

CORSAIR



VOUGHT-SIKORSKY AIRCRAFT DIVISION OF THE UNITED AIRCRAFT CORP., U.S.A. Single-seater Fleet fighter, in service with the U.S. Navy for operation with aircraft carriers. Official designation F4U-1. Powered by one 2,000 h.p. Pratt and Whitney 18-cylinder Twin Wasp air-cooled radial engine. Top speed is said to be 366 m.p.h. at 16,500ft., and the Corsair is reckoned to be the fastest ship-board fighter in the American Navy. Details of its armament have not been officially announced, but it is believed to comprise four .5in. machine guns in the wings. Its gross weight is just over 9,000lb. The wings of the cranked, or inverted-gull, type are of single-spar construction, and the fuselage is monocoque. Spot-welding is employed to provide a smooth skin. Dimensions: Span 40ft. 3in., length 31ft. 6in.

New Year Honours

Production Chiefs and Test Pilots Decorated : Many R.A.F. Awards

KNIGHTS BACHELOR

A. Dunbar, Controller Gen., Min. of Aircraft Production; A. F. Forbes, Dep. Sec., Min. of Aircraft Production; W. M. Morrison, Vice-Chairman and Managing Director, British Aluminium Co., Ltd.; G. H. Nelson, Chairman and Managing Director, English Electric Co., Ltd., for services to Min. of Aircraft Production and Min. of Supply; A. B. Winder, Director and Gen. Manager, English Steel Corpn., Ltd.

ORDER OF THE BATH

C.B.

L. G. S. Reynolds, Asst. Under-Sec., Air Min.; W. G. Stevens, Principal Asst. Sec., Min. of Aircraft Production.

ORDER OF ST. MICHAEL AND ST. GEORGE

C.M.G.

Hon. T. H. Brand, Ch. Exec. Officer on British side of Combined Production and Resources Bd., Washington; H. A. Jones, Sen. Admin. Officer, U.K. Air Liaison Mission, Ottawa.

ORDER OF THE BRITISH EMPIRE

C.B.E.

P. W. S. Bulman, lately head, Aircraft Testing Branch, British Air Comn., Washington; Comdre. G. J. R. L. D'Erlanger, Air Transport Auxiliary; W. F. Jenkins, M.B.E., Principal Dep. Director of Contracts, Min. of Aircraft Production.

ORDER OF THE BATH
ROYAL AIR FORCE

K.C.B. (MILITARY DIVISION)

Air Marshal Philip Babington, C.B.; Air Marshal Douglas Claude Strathern Evill, C.B.; Air Marshal Trafford Leigh Leigh-Mallory, C.B.

C.B. (MILITARY DIVISION)

A.V-M. H. V. Champion de Crespigny; A.V-M. the Hon. R. A. Cochrane; A.V-M. R. Graham; A.V-M. A. S. Morris; A.V-M. G. C. Pirie; A.V-M. R. P. Willock; Act. A.V-M. G. R. Bromet; Act. A.V-M. A. J. Capel; Act. A.V-M. M. B. Frew; Act. A.V-M. D. Harries; Air Comrde. J. W. Cordingley; Air Comdre. J. C. Quinnell.

C.B. (CIVIL DIVISION)

Air Comdre. A. D. Warrington-Morris (retd.), Commdt., R. Observer Corps from March, 1936, to June 24th, 1942.

ORDER OF THE BRITISH EMPIRE
ROYAL AIR FORCE

G.B.E. (MILITARY DIVISION)

Air Chief Marshal Sir Edgar Rainey Ludlow-Hewitt.

K.B.E. (MILITARY DIVISION)

Act. Air Marshal John Eustace Arthur Baldwin, C.B.E.

C.B.E. (MILITARY DIVISION)

A.V-M. C. H. K. Edmonds; Act. A.V-M. W. B. Callaway; Air Comdre. C. R. Cox; Air Comdre. E. J. Cuckney; Air Comdre. R. Harrison; Air Comdre. F. L. Hopps; Air Comdre. H. M. Probyn; Air Comdre. M. L. Taylor; Air Comdre. F. J. Vincent; Air Comdre. H. S. P. Walmsley; Act. Air Comdre. K. L. Boswell; Act. Air Comdre. K. B. Lloyd; Act. Air Comdre. E. J. Kingston-McCloughry; Act. Air Comdre. F. H. Sims; Grp. Capt. W. J. M. Akerman; Grp. Capt. G. G. Banting; Grp. Capt. N. H. D'Aeth; Grp. Capt. W. L. Freebody; Grp. Capt. G. D. Harvey; Grp. Capt. R. Kellett; Grp. Capt. E. R. Manning; Grp. Capt. C. B. R. Pelly; Grp. Capt. J. R. Scarlett-Streatfield; Grp. Capt. J. Silvester; Grp. Capt. L. F. Sinclair, G.C.; Grp. Capt. P. J. Wiseman; Act. Grp. Capt. A. M. Carey, R.A.F.O.; Col. H. G. Willmott, S.A.A.F.

O.B.E. (MILITARY DIVISION)

Wing Cdr. J. E. Atkins; Wing Cdr. F. H. Bell, R.A.F.V.R.; Wing Cdr. J. Bradshaw; Wing Cdr. W. D. Disbrey; Wing Cdr. Lord Malcolm Douglas-Hamilton, R.A.F.O.; Wing Cdr. W. H. Fallow, R.A.F.V.R.; Wing Cdr. R. A. Howes; Wing Cdr. W. H. Husbands; Wing Cdr. D. J. P. Lee; Wing Cdr. J. A. S. Outhwaite; Wing Cdr. M. K. D. Porter; Wing Cdr. D. Saward; Wing Cdr. L. V. Spencer; Wing Cdr. C. L. Stubbs; Wing Cdr. H. T. Sutton; Wing Cdr. C. Turl; Act. Wing Cdr. J. R. T. Bradford, A.A.F.R.O.; Act. Wing Cdr. H. E. Brushwood; Act. Wing Cdr. G. E. B. Christrie, R.A.F.V.R.; Act. Wing Cdr. J. E. Dunning, R.A.F.V.R.; Act. Wing Cdr. H. de V. Leigh, R.A.F.V.R.; Act. Wing Cdr. H. R. P. Patterson, R.A.F.V.R.; Act. Wing Cdr. D. M. Wallace, R.A.F.V.R.; Sqn. Ldr. R. R. Goodbody; Sqn. Ldr. A. B. Holloway, R.A.F.V.R.; Sqn. Ldr. J. A. Pring, R.A.F.V.R.; Act. Sqn. Ldr. A. E. Dunlop; Act. Sqn. Ldr. W. R. Hardeman; Act. Sqn. Ldr. H. P. Matthews; Wing Cdr. W. J. Duncan, R.A.A.F.; Wing Cdr. F. N. Wright, R.A.A.F.; Wing Officer L. M. Crowther, W.A.A.F.

M.B.E. (MILITARY DIVISION)

Act. Sqn. Ldr. H. L. Andrews; Act. Sqn. Ldr. C. B. Marshall, R.A.F.V.R.; Flt. Lt. (now Sqn. Ldr.) C. L. Ashford, R.A.F.V.R.; Flt. Lt. (now Act. Sqn. Ldr.) F. O. Baddiley, R.A.F.V.R.; Flt. Lt. S. H. Bonser, R.A.F.V.R.; Flt. Lt. (now Sqn. Ldr.) A. H. Bushell; Flt. Lt. M. P. Croft; Flt. Lt. H. E. Forster, R.A.F.O. (from Sept. 1st, 1942); Flt. Lt. W. H. Herbert; Flt. Lt. R. R. Knight, R.A.F.V.R.; Flt. Lt. S. D. Musson, R.A.F.V.R.; Flt. Lt. W. C. H. Oatey; Flt. Ltd. J. H. C. Saffery; Act. Flt. Lt. G. R. Crockett, R.A.F.V.R.; Act. Flt. Lt. E. C. H. Faulkner; Act. Flt. Lt. P. M. French; Act. Flt. Lt. (now Act. Sqn. Ldr.) T. Gallacher; Act. Flt. Lt. J. Healey; Act. Flt. Lt. E. Johns; Act. Flt. Lt. H. G. Kennard, R.A.F.V.R.; Act. Flt. Lt. G. W. Kirby, R.A.F.V.R.; Act. Flt. Lt. W. S. Lake, R.A.F.V.R.; Act. Flt. Lt. C. N. Lees, R.A.F.V.R.; Act. Flt. Lt. D. W. E. Penney; Act. Flt. Lt. (now Act. Sqn. Ldr.) C. E. Rolfe; Act. Flt. Lt. T. E. Vitty; F/O. G. S. W. Kerslake; F/O. R. H. Lamb, R.A.F.V.R.; F/O. W. Sims, R.A.F.V.R.; P/O. E. G. Strath; P/O. S. J. Woods; W/O. L. Bishop; W/O. A. M. Blackman; W/O. H. E. S. Casey; W/O. W. G. Clarke; W/O. D. A. Connors; W/O. J. L. Grimwood; W/O. A. E. Harland; W/O. H. J. Hill; W/O. V. E. Hill; W/O. J. H. Lloyd; W/O. C. T. Pearce; W/O. T. R. Powell; W/O. F. J. Rose; Act. W/O. W. E. Batchelor; F/O. G. J. Gow, R.C.A.F.; F/O. P. G. Hollick, W.A.A.F.

ORDER OF THE BRITISH EMPIRE

O.B.E. (CIVIL DIVISION)

S. J. G. Booth, works manager, Rootes Securities, Ltd., for services to Min. of Aircraft Production; Capt. A. C. P. Johnstone, British Overseas Airways Corpn.; E. T. Jones, F.R.Ae.S., Chief Technical Officer, Experimental Estab., Min. of Aircraft Production; R. H. Mathews, Senr. Met. Officer, Bomber Command, R.A.F.; F/O. J. K. Quill, R.A.F.O., Chief Test Pilot, Supermarine Works, Vickers-Armstrongs, Ltd.; Capt. D. F. Satchwell (F/O., R.A.F.O.), British Overseas Airways Corpn.; M. T. Spence, Senr. Met. Officer, H.Q., Bomber Command, R.A.F.; J. R. Woodcock, Dir. Civ. Repair Organzn. for Aircraft.

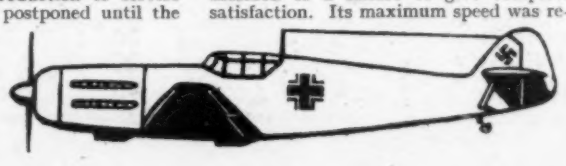
M.B.E. (CIVIL DIVISION)

E. A. Ayers, Fairey Aviation Co., V. Bleasdale, Airframe Factory, Rootes Securities, Ltd.; F. C. Bray, Fairey Aviation Co.; E. W. Bucknall, Irving Airchute of Gt. Britain, Ltd.; F. Cain, Air Ministry; C. Cook, Min. of Aircraft Production; H. D. Courtenay, Air Ministry; Lt. Col. E. G. T. T. Dalton, Observer Grp. Officer, Royal Observer Corps.

A further list of New Year Honours will appear in our next issue.

New German Types of 1942

ONE of the German types of aircraft in use on the Russian front during the past year, which is unfamiliar to Britons, is the Me 115. A French writer observes that this new fighter was first announced in 1941 and its introduction to service use was apparently postponed until the new 2,200 h.p. Daimler-Benz engine, the DB606, with 24 cylinders in X formation, had been perfected. Nevertheless, the fact that so little has been heard of this fighter of recent months can only be ascribed to a failure to give complete satisfaction. Its maximum speed was reported to approach 650 k.p.h., or round about 400 m.p.h.



A side elevation of the Me 115 which emphasises the typical Messerschmitt layout.

This same 24-cylinder DB unit is also applied to the new twin-engined Heinkel 177, which has an all-up weight of 20 tons. According to French sources, the He 177 has diving brakes of the slatted type and a bomb load of the order of 3½ to 4 tons.

The DB606 24-cylinder engine is in effect double DB601 engines with cylinders in X formation on a common crankcase, after the style of the Rolls-Royce Vulture applied to the Manchester.

CORRESPONDENCE

The Editor does not hold himself responsible for the views expressed by correspondents. The names and addresses of the writers, not necessarily for publication, must in all cases accompany letters.

THE TORPEDO BOMBER

"Armament or Eggs?"

I WOULD like to answer "Aero," whose letter was published in *Flight* of December 24th and who suggests that the Beaufighter should be used as a torpedo bomber.

First, he states that the already large armament should be enhanced by a multi-gun turret placed amidships like the Beaufort. The provision of this gun turret would cause extra drag, reduce the top speed, and also increase the weight. If this were done, the plane would have to carry four cannon and eight to ten machine-guns, complete with ammunition. Also, the nose would have to be lengthened to accommodate one or two torpedoes, or else the plane would be tail heavy. Another reason for the redesigned nose would be the new installation of the four cannon, which would have to make way for the torpedoes.

In the end this new version of the Beaufighter would look more like a Beaufort than a Beaufighter. If "Aero" favours the adoption of old types, I suggest a much simpler method would be to install the Beaufort with higher-powered engines. I think I ought to explain that the suggested torpedo bomber in my letter was meant to be land-based; that was the reason for its long range. Various correspondents have assumed that it was carrier-borne.

As I have mentioned in a previous letter, I do not think armament is essential to fast bomber planes. The measure of protection fast bombers lose by a reduction in armament they gain in speed and bomb load.

This last week or two, details have been published of the De Havilland Mosquito fast, long-range, light bomber. It has been officially stated that it can carry a load of bombs weighing 2,000 lb. That this aircraft must have a range of over 1,000 miles was shown by the raid on Oslo. With only slight alterations I think only one torpedo could be carried instead of the bombs. This would hardly affect its performance, and it would still have the armament on which some persons would insist. Or, if its armament were sacrificed, it could carry an extra torpedo. I would like to know if this idea meets with approval.

R. HUDSON.

UNNECESSARY SECRECY

Time to Lift the Veil

I SHOULD like to broach a subject which appears to have been bothering some readers of *Flight* for quite some time, and, apparently, all those interested in aircraft recognition.

The subject is that shroud of unnecessary and by no means leak-proof secrecy which surrounds our latest planes. The position at present is that almost every other country that matters in this war knows all about our planes, sometimes before we do ourselves. It must not be forgotten that this includes Germany.

Why should this be? Do we not deserve to know more about our own war machines?

Upon occasion I have seen references in the Correspondence pages of *Flight* about the lack of recognition data on new types. Very recently there was a letter stating that the Typhoon had been fired on by A.A. gunners, who, apparently, did not know it from an enemy machine!

An example of this state of affairs is in an article in a Sunday journal of December 13th by a person who, on visiting an exhibition "Somewhere in England," saw, to his amazement, a model of the Hawker Typhoon!

As if this were not enough, the same person overheard a visitor ask one of the officials if he could photograph it! He was told he could, "because there was not any reason why he shouldn't!"

When things like this are allowed to happen, I fail to see what good there is in keeping the machine in question on the secret list. I am sure that *Flight* could use its undoubtedly strong influence to help lift this shroud which hangs about our aircraft.

Photographs would not assist the enemy much if no technical data were given. In addition, more can be learnt from a model, such as the proportions and a three-dimensional grasp of the layout.

If this country were Germany or America, we should see plenty of heartening propaganda on the excellence of our new types, instead of their being hidden away.

I am not in favour of boasting, but cannot we blow our own horn once in a while? In my opinion it would do no harm, as many keen spotters, on seeing a new and strange type in British war-paint, can very often put two and two together and arrive at the truth.

I hope to see more written on this subject in the near future.

G. S. HENDERSON.

FAULTY FILMS

Entertainment Plus Instruction

MR. KERR-TRIMMER, whose letter sub-headed "Studios Working Under Difficulties" appears in the issue of your journal of November 26th, seems slightly confused as to just how much care *was* taken in "The First of the Few" to ensure the technical and historical accuracy which the film was purported to possess.

He states that "In this film (and I say this with first-hand knowledge) a *great deal* of trouble was taken to ensure accuracy," and follows this with ". . . but it was definitely a case of *not quite enough* trouble."

Later he mentions ". . . a *considerable* amount of mistakes which I will not attempt to deny."

There can be little doubt that, although the film was an excellent production in many respects, there were so many *avoidable* mistakes, immediately apparent to the average aeronautical enthusiast, that much justifiable criticism was levelled at it on this account. Your correspondent mentions "the bugbear of security measures" and "lack of labour and materials." I think it doubtful that the accurate representation of the various machines in the period covered would have conveyed any secret information to the enemy. Also, very little labour and material would have been involved in giving the prototype Spitfire its correct markings.

I am pretty certain that the majority of those who went to see the film in question did so not only to be entertained, but because they believed it told them something about one of the two great fighters in the Battle of Britain.

May I repeat what I said in my letter of a few weeks ago: "Films on aviation should be accurate unless there is a good reason for introducing an inaccuracy." Mr. Kerr-Trimmer's mention of a new film on Hurricanes in Russia, being made under the technical advice of Wing Cdr. Ramsbottom-Isherwood, encourages the hope that this principle is being more widely appreciated.

S. W. GREENWOOD.

SEVERSKY SPEAKS OUT

Have We Done So Well?

DOUBTLESS the British people will be gratified at having Mr. Henderson to champion them, but I must point out to him that I have never criticised them. My remarks were directed against the papers.

As Mr. Henderson says (*Flight*, December 3rd) the direct-injection engine offers the best performance at altitude, and it also has certain advantages in aerobatic flying. Hence my desire to see an English example.

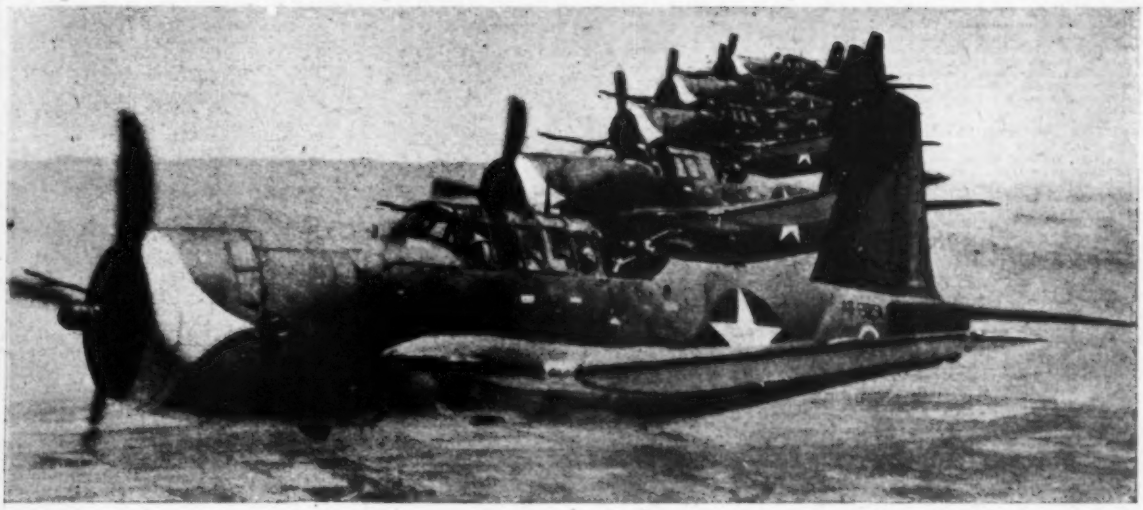
Perhaps my sense of humour is moribund, but I cannot see anything comic in a plea for a dive-bomber. Had we had one, the German ships from Brest would hardly have steamed through the Straits of Dover. Mr. Henderson tells us that we have done pretty well without them, but is to lose 1,000,000 square miles of our Empire "doing well"? As a matter of fact, he contradicts his own statement in a previous paragraph by referring to the amount of bad news we have had up to now.

I agree with him that the technical accuracy and general veracity of *Flight* is unique in journalism, and I am fully prepared to accept the new Spitfire as being faster than the Fw 190.

But at the same time we must remember that details of this machine had not been published when our correspondence began.

We are both fully in accord with regard to Mr. Henderson's final list of technical achievements standing to the credit of the British aircraft industry.

J. V. HEWES.



ECHELON TO STARBOARD : Six Vultee dive-bombers in formation. The R.A.F. version, under the name of Vengeance, has a G.R. 2,600 double-row Cyclone engine of 1,600 h.p.

SERVICE AVIATION

Royal Air Force and Fleet Air Arm News and Announcements

Retirement

The London Gazette, December 18th, 1942.

GENERAL DUTIES BRANCH.

Grp. Capt. (temp. Air Cmdre.) S. L. HOWARD-WILLIAMS, M.C., is placed on retired list at his own request, and retains rank of Air Cmdre., November 23rd, 1942.

Awards

THE KING has been graciously pleased to approve the following appointments :—

O.B.E. (MIL.)

Wing Cdr. J. R. JEUDWINE, No. 84 Sqn.—When the order for evacuation was given at Bandoeng, the squadron aircrews proceeded to Tjilljap and awaited embarkation. Wing Cdr. Jeudwine, undaunted by the non-appearance of the ship detailed, immediately set to work to save as many of his squadron as possible from falling into the hands of the Japanese. He refused to believe that all channels of escape were closed. Wing Cdr. Jeudwine set out in a car to search the neighbouring ports and coastline for a suitable craft. Two lifeboats were discovered on the upper deck of a bombed ship, which he decided to use as a last resort. During his absence a party, detailed by him, set out to procure the necessary provisions and navigational equipment for the voyage. Wing Cdr. Jeudwine, being unable to find any other suitable craft, decided to use the lifeboats and ordered them to be lowered and made ready. During the voyage his ingenuity and sound seamanship enabled the craft to be kept seaworthy in spite of recurring mishaps to the boat and its gear. Many repairs to the rudder were carried out as a result of his resourcefulness and refusal to accept defeat. The repairs necessitated working overboard, and Wing Cdr. Jeudwine insisted on sharing the risks in a shark-infested sea.

M.B.E. (MIL.)

F/O. F. CONWAY, R.A.F.V.R.—While on duty as Master of launch 177 on August 19th, 1942. F/O. Conway observed other small vessels being attacked by enemy aircraft. He immediately informed base of what was happening and proceeded to obtain the assistance of a naval craft. In company with that vessel he proceeded to the scene of the attack where he found the launches 122 and 123 burning fiercely. While launch 177 was speeding to their assistance she was made the object of five separate attacks by enemy aircraft. During these attacks she fought back with all her guns and proceeded steadily towards the launches in distress. The attacks by enemy aircraft had ceased by the time she reached the burning launches, and the work of rescuing the personnel proceeded smoothly and efficiently. F/O. Conway did not permit trying circumstances or great personal danger to deter him from carrying out his duty, and it was largely due to his great courage, determination and devotion to duty that so many lives were saved.

F/O. A. W. R. TRIGGS, R.A.A.F., No. 172 Sqn.—One night in August, 1942, F/O. Triggs was captain of a Wellington aircraft engaged on patrol duties in the vicinity of the Bay of Biscay. The port engine failed and it was necessary to bring the aircraft down on to the sea in complete darkness at a point some 110 miles from land. This was achieved successfully and without injury to the crew, although the second pilot, who was found to be under water, had to be lifted out through the escape hatch on to the wing by F/O. Triggs. The dinghy releases having failed, F/O. Triggs tore off the cover and pulled out the dinghy which at once became inflated. He saw the crew safely aboard and then, as the emergency pack was seen floating away, he swam out and retrieved it. The crew was eventually rescued after having been at sea for 124 hours.

P/O. S. S. BATES, R.A.F.V.R.—While on duty as Master of launch 123 on August 19th, 1942, P/O. Bates observed that launch 122 was being attacked by some six enemy aircraft and had been set on fire. In spite of the great risk incurred, P/O. Bates at once went to the assistance of launch 122, and was himself attacked by enemy aircraft. Although under attack he proceeded calmly with the rescue of the survivors of launch 122. Launch 123 was also set on fire and suffered casualties, and had to be abandoned. The crew jumped into the sea. P/O. Bates' devotion to duty and persistence in the face of danger undoubtedly saved the lives of the surviving personnel of the other launch. P/O. Bates has served at his present base for some six months, and his keenness throughout has been an inspiration to officers and men alike.

Act. W/O. J. G. M. DAVIS, B.E.M., No. 148 Sqn.—W/O. Davis was on duty in the armament section of his squadron when he was advised that a Wellington aircraft was on fire on a landing ground nearby. Knowing that the aircraft had a number of high explosive and incendiary bombs on board he led a party of four to the scene with the intention of removing the bombs from the aircraft and rolling them away to safety. When he reached the Wellington he found the rear of the fuselage and the entire starboard wing on fire and realised that the fuel tanks or bombs might explode at any moment. Disregarding this grave danger, W/O. Davis entered the aircraft and, after ascertaining that all bomb fuses were in the safe position, he connected the accumulators to the bomb release gear and jettisoned the entire load. He then left the aircraft and, with his four assistants, was ready to roll the bombs clear. He found that by this time the burning starboard wing was about to collapse; he accordingly ordered his men to stand away. Shortly afterwards the petrol tanks burst and the bombs exploded. The action of W/O. Davis in causing the bombs to be on the ground when they exploded minimised the effect of the explosion. Had they detonated while inside the aircraft considerable damage might have been caused to other aircraft in the vicinity by burning fragments scattered by the explosions. This possible catastrophe was averted by the gallant action of W/O. Davis.

Sqn. Ldr. R. Hanson who has been awarded the D.F.C. for attacking U-boats in Northern waters.

THE KING has been graciously pleased to approve the following awards in recognition of gallantry displayed in flying operations against the enemy :—

DISTINGUISHED SERVICE ORDER

Act. Wing Cdr. S. B. BINTLEY, A.F.C., No. 102 Sqn. (since deceased).—This officer had a varied operational career. In the early months of the war he flew for many hours over the sea on convoy patrols, and latterly took part in attacks on some of the most strongly defended industrial targets in Germany.

Act. Sqn. Ldr. P. R. CASEMENT, D.F.C., No. 61 Sqn.—Sqn. Ldr. Casement has an outstanding record as an operational bombing pilot which has been an example to all air crews. His courage and determination have been of the highest order.

Act. Sqn. Ldr. A. P. DART, D.F.C., R.A.F.V.R.,

No. 419 (R.C.A.F.) Sqn.—This officer has taken part in many of the most successful attacks on enemy targets, including Cologne, Rostock and the Renault factory at Paris. He has also participated in daylight raids on the German battleships *Scharnhorst* and *Gneisenau*, and in mine-laying operations. He has always displayed skilful airmanship in the face of concentrated defences.

BAR TO DISTINGUISHED FLYING CROSS.

Flt. Lt. L. C. PIPKIN, D.F.C., R.A.F.V.R., No. 103 Sqn.—In September, 1942, this officer was the navigator of an aircraft detailed to attack a target in the Ruhr. In most hazardous circumstances he displayed courage and devotion to duty in keeping with the highest traditions of the R.A.F.

F/O. R. O. CALVERT, D.F.C., R.N.Z.A.F., No. 50 Sqn.—As pilot and navigator of aircraft respectively, F/O. Calvert and Flt. Sgt. Medani have participated in numerous sorties, including attacks on heavily defended areas in Western Germany, and daylight raids on Le Creusot and Milan. During a recent sortie, F/O. Calvert's aircraft was subjected to heavy anti-aircraft fire, sustaining much damage. The wireless operator was killed and both the pilot and navigator were wounded. The aircraft became difficult to control, but F/O. Calvert, although he had a piece of shell splinter embedded in his left arm, set course for home. Flt. Sgt. Medani, despite the severity of his wound and subsequent loss of blood, continued his duties until he collapsed. Even so, he succeeded in giving his pilot a final course which enabled him to reach an airfield in this country where he made a skilful crash landing in bad visibility.

Sqn. Ldr. P. R. CROMPTON, D.F.C., R.A.F.V.R.—In September, 1942, Sqn. Ldr. Crompton was detailed to take part in an attack on Dusseldorf. After crossing the Dutch coast he was attacked by a hostile aircraft, which secured many hits. Despite his badly damaged bomber, Sqn. Ldr. Crompton proceeded to the target, bombed it, and flew safely back to base.

Act. Sqn. Ldr. J. DE L. WOOLDRIDGE, D.F.C., D.F.M., R.A.F.V.R., No. 106 Sqn.—Since being awarded the D.F.C. in June, 1942, Sqn. Ldr. Wooldridge has taken part in attacks on Bremen, Dusseldorf, Duisberg and other towns in the Ruhr, and mining operations.

DISTINGUISHED FLYING CROSS.

Wing Cdr. C. A. MASTERMAN, O.B.E., No. 227 Sqn.—This officer has led his squadron with great skill and dash. During a flight one day in November, 1942, a large formation of enemy aircraft was intercepted over the Sicilian Channel. In the ensuing engagement seven of these were destroyed and several more probably destroyed. Wing Cdr. Masterman destroyed a S.M.81. Within two weeks the squadron has destroyed 16 hostile aircraft in combat as well as others on the ground, while in attacks on shipping, trains, road columns and fuel dumps much damage and disorganisation were caused.

Act. Wing Cdr. D. T. SAVILLE, R.A.F.V.R., No. 104 Sqn.—Within two weeks of his arrival in Malta, this officer completed numerous sorties. In November, 1942, at night, he took part in an attack on an airfield at Tunis. In spite of heavy opposition and bad weather, the objective was bombed from a low level. The next night he participated in three attacks on Comiso airfield, where a large fire was started.

Act. Sqn. Ldr. D. G. LONG, No. 57 Sqn.

F/O. E. W. G. ROSAM, D.F.M., R.A.F.V.R., No. 57 Sqn.—In November, 1942, Sqn. Ldr. Long and F/O. Rosam were captain and wireless operator respectively of an aircraft which was detailed to attack Genoa. On the outward flight, shortly after crossing enemy territory, engine trouble developed. Despite this, Sqn. Ldr. Long continued his mission, reached his target and bombed it. Soon after leaving the target area the port outer engine caught fire and ceased to function. Displaying fine airmanship and ably supported by F/O. Rosam, whose wireless skill was of the greatest value, Sqn. Ldr. Long flew his aircraft back to this country and effected a masterly landing in difficult circumstances.

Full Load Landing

P/O. H. E. DABBS, R.C.A.F., No. 101 Sqn. (since reported missing).—One night in December, 1942, this officer was pilot of an aircraft detailed to attack Frankfurt. When nearing the target area his aircraft, whilst held in a cone of searchlights, was hit by anti-aircraft fire and one of its engines was put out of action. Despite this, P/O. Dabbs flew on to his target but, as the bomb release mechanism was unserviceable, he was unable to drop his bombs. Displaying skilful airmanship he flew his aircraft back to this country without the aid of wireless. With a full bomb load he made a masterly landing in poor visibility. This officer has flown on several sorties with distinction.

Act. Sqn. Ldr P. C. FLETCHER, R.A.F.V.R., No. 258 Sqn.—One day in April, 1942, Sqn. Ldr. Fletcher led his squadron against a formation of enemy dive-bombers which were attempting to attack shipping in Colombo Harbour. In the ensuing combat, during which at least five of the bombers were destroyed, his own aircraft was hit, and later, when attacked by a hostile fighter, it burst into flames. Sqn. Ldr. Fletcher was compelled to descend by parachute. Throughout this hazardous operation, in which he was wounded, this officer displayed fine courage and leadership and destroyed one of the five enemy aircraft.

Flt. Lt. S. R. PEACOCK-EDWARDS, No. 258 Sqn.—Since September, 1939, this officer has flown in many operational sorties both in bomber and fighter aircraft. One day in April, 1942, during an air attack on Colombo, he engaged six enemy aircraft, following them down and destroying at least one of them. He has destroyed at least four enemy aircraft.

F/O. P. J. GIBBES, R.A.A.F., No. 1 Sqn.—F/O. Gibbes has performed many operational sorties with distinction. On one occasion during January, 1942, he successfully carried out a low-level attack on an armed Japanese wireless ship at sea. F/O. Gibbes was flying a Hudson aircraft. The attack was carried out mast high and was pressed home to such an extent that Gibbes scored a hit with each of his four bombs. The result was not observed at the time, but the ship was not sighted in the area again. F/O. Gibbes, in February, 1942, successfully accomplished a reconnaissance of the Japanese convoy and escort which had assembled at the Anamba Islands. F/O. Gibbes took off from Palembang II, Sumatra, made a sketch of the disposition of the enemy ships, successfully evaded the defence weapons of the escort and landed at Singapore, where he delivered his report to the Headquarters of the Far East Command. The enemy had, at the time, air superiority over Singapore. The airfield where F/O. Gibbes landed had been very seriously damaged by enemy bombing. After delivering the report, he took off and returned to Palembang. Another outstanding exploit in which this officer proved his courage was at R.A.F. station, Kalijati, Java. Here, whilst under concentrated fire from the enemy, actually on the airfield and equipped with tanks and motor cycle troops with Tommy guns, he ran across the airfield to his aircraft, started the motors while lying flat on the floor to escape machine-gun fire, and immediately both engines started, opened the throttles, leapt into the pilot's seat, and took off across the dispersal area which was dangerously littered with bomb craters. Just before he was airborne, he opened up with his front guns, killing a motor cyclist directly ahead of him, who was continually firing at the aircraft with his Tommy gun.

Act. Sqn. Ldr. T. J. GUNN, R.A.F.O., No. 161 Sqn.—This officer has commanded an operational flight for the past six months, and has achieved most successful results. At all times he has shown exceptional enthusiasm for operational duties.

Flt. Lt. A. F. CHISHOLM, No. 83 Sqn.—This officer has participated in numerous sorties. In July, 1942, he was the bomb-aimer of an aircraft which attacked Danzig. Despite unfavourable weather, his skilful map-reading was of the greatest assistance, and undoubtedly enabled his pilot to reach the target area. On another occasion, over Dusseldorf, his aircraft was subjected to heavy fire from the ground defences. Although he was severely shaken by the violent evasive action which his pilot was forced to take, Flt. Lt. Chisholm did not allow this to impair his determination to press home accurately his attack after the aircraft had regained the necessary height. Prior to joining his present squadron, this officer participated in many daylight operations in France and the Low Countries.

Flt. Lt. T. G. MOORE, No. 115 Sqn.—As captain of aircraft this officer has taken part in many operational sorties, including attacks on Berlin, Hamburg, and the Ruhr Valley. Throughout he has shown great devotion to duty, and his cheerful spirit in the face of difficulties has been an inspiration to all.

Act. Flt. Lt. M. A. BROGAN, R.A.F.V.R., No. 149 Sqn.—This captain of aircraft has successfully attacked some of the most heavily defended targets in Germany. He has always performed his duties in a most determined and conscientious manner, often in the face of heavy enemy opposition.

Act. Flt. Lt. J. H. EVANS, R.A.F.V.R., No. 44 Sqn.—Flt. Lt. Evans is a navigator of high merit. He has at all times performed his tasks in a most conscientious manner, and has proved a great asset to the squadron. He has participated in attacks on a wide range of heavily defended targets.

Many Sorties

Act. Flt. Lt. R. B. SPEAR, R.N.Z.A.F., No. 218 Sqn.—Since May, 1942, Flt. Lt. Spear has participated in many operational sorties with outstanding success. In August, 1942, he pressed home an attack on a target in Mainz despite intense opposition. On another occasion, in September, when over enemy territory his aircraft was attacked by two hostile fighters, but by skilful manœuvring he succeeded in evading them, although his aircraft suffered damage. With great determination he proceeded to his objective, and despite heavy anti-aircraft fire, released his bombs and flew safely back to base.

Act. Flt. Lt. N. F. WALKER, R.A.F.V.R., No. 83 Sqn.—This officer is a navigator of outstanding ability. He has participated in attacks on many enemy targets, including Bremen, Brest, Cologne, Hamburg, and other heavily defended areas. During the past three months Flt. Lt. Walker has been employed as squadron navigation officer. By his keenness and untiring efforts, he has done much to raise the standard of navigation in his squadron.

Act. Flt. Lt. J. L. WILKINSON, R.A.F.V.R., No. 12 Sqn.—Since June, 1941, this officer has been employed as an air-gunner. In July, 1941, whilst attacking the German battleships *Scharnhorst* and *Gneisenau* in daylight, he was wounded. Nevertheless, he continued to man the turret, passing to the captain an excellent running commentary, thus enabling him to avoid balloons and fighters. As squadron gunnery leader, Flt. Lt. Wilkinson's cheerful bearing and keenness to get at grips with the enemy have been an excellent example to his crew and squadron.

BAR TO DISTINGUISHED FLYING MEDAL

Flt. Sgt. W. F. HORNER, D.F.M., No. 207 Sqn.—Since Flt. Sgt. Horner was awarded the D.F.M. he has greatly enhanced his reputation. His resolution and resource have probably saved his crew on at least two occasions.

Flt. Sgt. R. L. TURNER, D.F.M., No. 97 Sqn.—Flt. Sgt. Turner has participated in attacks against many targets in Germany, and recently he flew on one of the Genoa raids and in a daylight attack on Milan. As wireless operator/air gunner, his ability, courage and devotion to duty have made him a most valuable member of aircraft crew.

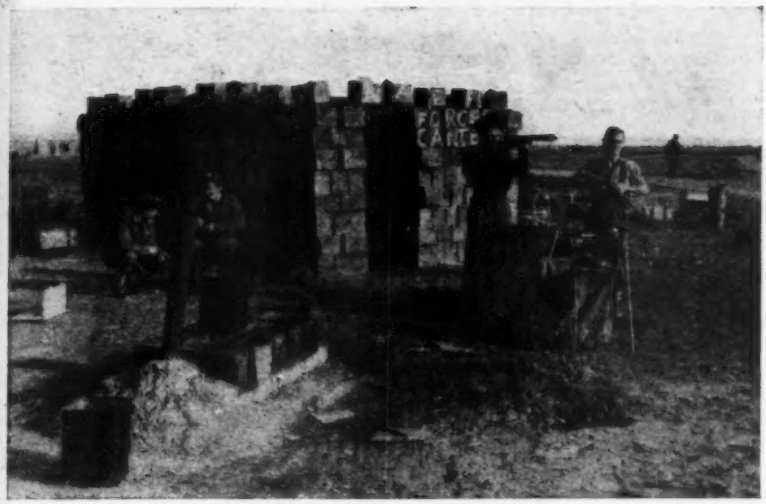
DISTINGUISHED FLYING MEDAL.

Flt. Sgt. J. MEDANI, No. 50 Sqn.—For citation see F/O. Calvert, D.F.C.

Sgt. H. MORRISSY, R.C.A.F., No. 102 Sqn. (since reported missing).—One night in November, 1942, Sgt. Morrissy captained an aircraft detailed to attack Turin. During the take-off, the hatch cover above his head blew open and all attempts to close and secure it were unavailing. Although it was necessary to jettison the hatch cover, leaving him exposed to intense cold and extreme discomfort, Sgt. Morrissy flew on to the target and successfully bombed it.

Flt. Sgt. W. E. EGRI, R.C.A.F., No. 15 Sqn.—During a recent sortie this airman was the rear gunner of a heavy bomber which was attacked by two Ju 88s. In the face of strong attacks, Flt. Sgt. Egri maintained a steady and accurate fire and probably destroyed one of the attackers and caused the other to break off the engagement. His aircraft had sustained much damage and a fire broke out, but Flt. Sgt. Egri assisted in extinguishing the flames with his gloved hands

A Dornier 18 being swung out on to the water for convoy-spotting patrol from the French coast.



NORTH AFRICAN CANTEEN: In Africa and the Middle East the standard four-gallon petrol tin has manifold uses. It is saucepan, kettle, fire-box, bath, water carrier and building material all rolled into one. It also has a definite currency value with the native population.

and a fire extinguisher. His hands were severely burned, but he returned to his post and, although his turret was unserviceable, he rotated it manually to keep watch.

Flt. Sgt. F. F. HAMILTON, R.C.A.F., No. 15 Sqn.—Flt. Sgt. Hamilton, as captain of an aircraft, flew in a recent sortie to Genoa. Shortly after crossing the Alps on the outward journey, one engine in his aircraft ceased to function. Although the aircraft was losing height, he flew on and released his bombs over the target. On the return journey he displayed considerable skill in manœuvring his aircraft through various passes in the Alps, when unable to fly higher than 6,000 feet.

Flt. Sgt. D. D. SODERQUIST, R.C.A.F., No. 15 Sqn.—During a recent sortie the aircraft in which this airman was flying as mid-upper gunner was attacked by two Ju 88s. Flt. Sgt. Soderquist was wounded in the arm and his turret was damaged. In spite of this he maintained accurate fire, finally destroying one of the attacking aircraft and causing the other to discontinue the engagement.

Airfield Attacks

Sgt. G. A. TUCKWELL, No. 272 Sqn.—Sgt. Tuckwell has participated in a large number of sorties, involving attacks on enemy airfields, E-boats and shipping. In November, 1942, during a low level attack on the airfield at El Aouina, he set alight two enemy aircraft on the ground and damaged others. Some days later, when attacking the same target, he machine-gunned two large German aircraft on the ground, setting them on fire; he also silenced an anti-aircraft gun. His squadron commander's aircraft was hit by anti-aircraft fire, but Sgt. Tuckwell covered his landing in the face of heavy opposition. He has destroyed five enemy aircraft in combat.

Flt. Sgt. G. B. TWEEDALE, R.A.A.F. (since deceased).—This airman has always shown courage and a desire to engage the enemy. On one occasion he pursued a Ju. 88 to within ten miles of the Sicilian coast and shot it down, thereafter having to fend off attacking aircraft when completely out of ammunition. On another occasion he destroyed a Ju.87 over Calafrana Bay, in spite of intense enemy fighter opposition.

Flt. Sgt. J. H. ALLEN, No. 83 Sqn.—In July, 1942, Flt. Sgt. Allen took part in a daylight attack on Danzig. Although most unfavourable weather was encountered the attack was successfully made from well below cloud base. This was due largely to the skill displayed by Flt. Sgt. Allen. Later in the month he participated in a daylight operation on a heavily defended town in the Ruhr. While the aircraft was over the Ruhr area it was subjected to intense anti-aircraft fire, but the attack was pressed home calmly and with great determination. On the return journey the bomber was attacked by enemy fighters. Much damage was sustained and the rear gunner was seriously wounded. Throughout this hazardous trip Flt. Sgt. Allen imperturbably and skilfully assisted the navigator and materially contributed to the safe return of the bomber.

Flt. Sgt. S. B. ALLISON, R.A.F.V.R., No. 44 Sqn.—Flt. Sgt. Allison has never had a wireless failure. His standard of wireless operating is very high, and his experience and technical knowledge have been invaluable. He has always shown an indomitable spirit and an extraordinary ability to inspire the crew by his cheerfulness when facing difficult or dangerous situations.

Flt. Sgt. J. R. ANDERSON, No. 61 Sqn.—Flt. Sgt. Anderson has taken part in attacks on most of the highly defended targets in Germany, including a daylight raid on Danzig. The excellent photographs which have been secured are in a large measure due to this airman's skill as navigator.

Flt. Sgt. A. W. J. BAKER, No. 149 Sqn.—Flt. Sgt. Baker has participated in many operational sorties as rear gunner. Throughout, he has shown the greatest determination and efficiency both on the ground and in the air. On two occasions his clear and precise instructions to his pilot have been largely responsible for the safe return of his aircraft.

Three "Over 1,000" Raids

Flt. Sgt. W. P. BATES, No. 106 Sqn.—Flt. Sgt. Bates is a navigator of great ability who has taken part in attacks on most of the important and heavily defended enemy targets in the Ruhr. He has also participated in attacks on Rostock, Warnemunde and Munich, and in the three "1,000 bomber raids." He has also flown on many mine-laying sorties, and much of their success has been due to his flawless navigation over long stretches of sea.

Flt. Sgt. W. E. BARRETT, R.A.F.V.R., No. 207 Sqn.—Flt. Sgt. Barrett has shown great courage and initiative when flying on operations. He is a member of a highly successful crew, and his cheerful nature and quiet efficiency have materially contributed to their achievements.

Flt. Sgt. L. J. BOUCHER, R.C.A.F., No. 405 (R.C.A.F.) Sqn.—As wireless operator/air gunner, this airman has participated in many attacks on the enemy's industrial centres in the Ruhr, as well as important ports such as Hamburg, Brest, St. Nazaire and Kiel.

Flt. Sgt. C. M. BOWRING, No. 102 Sqn.—As rear gunner, Flt. Sgt. Bowring has been continually engaged on operational flying. He has proved himself to be an air gunner of high merit and, by his courage and alertness, has been responsible for the safe return of his aircraft on many occasions. Flt. Sgt. Bowring has destroyed one and damaged other enemy aircraft. He has participated in attacks on a wide variety of targets, including industrial centres in the Ruhr.

Flt. Sgt. B. C. BULL, No. 218 Sqn.—As wireless operator/air gunner, this airman's record is one of sustained courage and distinction. In April, 1942, he was a member of the crew of a Wellington which attacked an enemy airfield. Throughout a most determined attack Flt. Sgt. Bull used his guns with telling effect. On several occasions he has been engaged in combat against enemy fighters. On one occasion, on the outward flight to Lubeck in daylight, his aircraft was attacked by three Me 109s. Flt. Sgt. Bull used his guns effectively, causing one of the attackers to break away emitting a long trail of smoke.

Flt. Sgt. T. L. CASS, R.A.F.V.R., No. 61 Sqn.—Flt. Sgt. Cass has displayed great determination as tail gunner. He has participated in attacks on many of the important targets in Germany, and also took part in the daylight raid on Danzig.

Flt. Sgt. H. F. CONNELY, R.A.A.F., No. 97 Sqn.—Flt. Sgt. Connely has successfully completed many operational sorties against some of the enemy's most heavily defended targets, including Danzig, Bremen, Wilhelmshaven and the Ruhr Valley. He also took part in the recent daylight attack on Le Creusot. Throughout, his standard of navigation has been high, and he has consistently obtained excellent photographs.

Awards of Foreign Decorations
Royal Air Force

THE KING has granted unrestricted permission for the wearing of the undermentioned decorations and medal, conferred on the officers and airman indicated, in recognition of valuable services rendered in connection with the war:—

ORDER OF ST. OLAV (GRAND CROSS).

Air Chief Marshal Sir C. F. A. PORTAL, G.C.B., D.S.O., M.C.

ORDER OF ST. OLAV (COMMANDER).

Grp. Capt. C. F. H. GRACE.

ORDER OF ST. OLAV (KNIGHT, FIRST CLASS).

Wing Cdr. D. E. B. WHEELER.
Wing Cdr. V. C. WOOD, A.F.C.

NORWEGIAN WAR CROSS.

Act. Air Cmdre. W. WHITNEY-STRAIGHT, M.C., D.F.C., A.A.F.
Grp. Capt. H. L. R. ATCHERLEY, O.B.E., A.F.C.
Act. Wing Cdr. E. J. FAWDRY, R.A.F.V.R.
Act. Flt. Lt. D. E. HEALY, D.S.O., R.A.F.V.R. (since deceased)

NORWEGIAN WAR MEDAL.

Sgt. T. R. THOMAS.

Roll of Honour

Casualty Communiqué No. 187.

THE Air Ministry regrets to announce the following casualties on various dates. The next of kin have been informed. Casualties "in action" are due to flying operations against the enemy; "on active service" includes ground casualties due to enemy action, non-operational flying casualties, fatal accidents and natural deaths.

Royal Air Force

KILLED IN ACTION.—Sgt. G. A. Corbett; Sgt. S. C. Garrett; Sgt. H. Male; Sgt. A. J. F. Sims; Flt. Sgt. D. A. Wahern; Sgt. S. Woolley.

PREVIOUSLY REPORTED MISSING, NOW PRESUMED KILLED IN ACTION.—Sgt. K. E. Hall.

WOUNDED OR INJURED IN ACTION.—F/O. R. N. R. Getteman; W/O. G. D. Y. Pollock.

MISSING, BELIEVED KILLED IN ACTION.—Sgt. G. E. Dunn; Flt. Sgt. D. H. Freeland; P/O. E. W. T. Gibbs; Flt. Sgt. F. G. Green; Sgt. E. G. Hayhoe; F/O. C. T. Holland; Sgt. D. N. Huntley, D.F.M.; Sgt. F. T. P. Jones; P/O. C. H. Lovegrove; W/O. T. M. Manning; Sgt. J. G. Mellor; Sgt. P. C. Murphy; Sgt. A. E. Richardson; Sgt. J. R. Roberts; P/O. F. C. Smith; Flt. Lt. P. H. Tippetts-Aylmer, D.F.C.; Sgt. A. Williams; Sgt. B. W. Williams; Sgt. R. E. Williams; P/O. W. O. Williams; Sgt. P. Witcomb.

MISSING.—Flt. Sgt. P. J. Apps; F/O. R. E. Atkinson; Sgt. P. H. Bath; Sgt. R. W. Beales; Flt. Sgt. J. A. Beaton; Sgt. R. Bell; Sgt. G. Bennet; Sgt. R. L. Berry; Sgt. L. F. G. Boreham; Sgt. G. L. Boxall; Sgt. G. Brothwell; Sgt. A. J. J. Brooks; Sgt. F. Buckley; Sgt. P. G. Burrell; P/O. H. Butler; F/O. A. J. Calvert; Sgt. J. C. Coulthard; Sgt. L. S. Cowell; Sgt. C. C. W. Crofton; Sgt. L. A. Crossley; Sgt. W. H. Davidson; Flt. Sgt. G. K. Dickenson; Sgt. F. A. Digby; Sgt. B. R. Dixon; Sgt. T. E. Donnelly; Sgt. W. L. Doodson; Sgt. E. B. Doubiard; P/O. D. J. Downer; Sgt. C. G. Gaddes; P/O. P. F. W. Gales; W/O. M. W. Gilding; Act. F/O. S. E. Groves; Sgt. H. Hellewell; Flt. Sgt. I. J. A. Henderson; Sgt. P. W. A. Higson; Sgt. N. J. Hill; Sgt. L. Jackson; Sgt. W. Johnstone; F/O. R. Jones; Sgt. J. H. Kaufman; Sgt. L. Kelly; Sgt. B. J. Landen; Sgt. F. Lister; Flt. Lt. E. F. W. McCartan-Mooney; Sgt. J. C. McGann; Sgt. J. C. Martin; Sgt. N. R. Millson; P/O. R. B. Muirhead; Sgt. C. T. Ord; Sgt. C. Owens; Sqn. Ldr. V. R. Paterson, D.F.C.; Sgt. H. N. Pleass; Sgt. B. Prole; Sgt. J. M. Pye; Sgt. H. T. Ramsden; Act. Sqn. Ldr. C. Raymond, D.F.C.; Sgt. J. A. Richards; Sgt. A. V. Riggs; Flt. Sgt. E. J. Rowe; Sgt. C. H. Russell-Collins; Flt. Sgt. K. Rutherford; Sgt. W. Sheldon; F/O. P. D. Short; Sgt. J. T. Spirit; Flt. Lt. A. P. V. Strachan; Sgt. A. E. Thomas; Sgt. W. H. Trottier; Act. Sgt. G. W. A. H. Vasil; Flt. Sgt. H. J. Wade; Sgt. J. J. Watson; Sgt. T. S. White; Sgt. D. J. Wood; Flt. Sgt. H. Yates.

MISSING, BELIEVED KILLED ON ACTIVE SERVICE.—A/C.2 G. Crowley; P/O. J. W. Southall.

KILLED ON ACTIVE SERVICE.—L.A/C. A. Beaty; Sgt. D. R. Bird; Sqn. Ldr. V. M. Bright; L.A/C. R. F. Brown; Sgt. K. Coates; L.A/C. A. J. S. Dick; Sgt. J. M. Erickson; Sgt. D. R. Evans; P/O. G. Fisher; W/O. R. J. Fulbrook, D.F.C.; Sgt. A. H. Gibbons; Flt. Sgt. E. G. Godfrey; Sgt. J. Hassall; Sgt. A. W. Hawkes; Sgt. A. Higson; Sgt. F. W. Hill; Sgt. J. P. Hookey; L.A/C. G. A. Horne; Sgt. W. R. Hughes; L.A/C. R. D. Hume; A/C.2 G. P. Hunter; Sgt. J. L. Johnson; Flt. Sgt. L. R. Milner; Flt. Sgt. J. P. Morris; Flt. Sgt. R. E. G. Oxenham; L.A/C. C. O. H. Rawson; Sgt. V. R. Smith; P/O. R. J. Stevens; A/C.1 R. E. L. Stevens; Sgt. L. D. L. Wadden; Sgt. J. P. Wollenden.

WOUNDED OR INJURED ON ACTIVE SERVICE.—L.A/C. R. J. Curtis; Sgt. P. M. Hamilton; Act. F/O. W. Laing; L.A/C. R. E. Monk; L.A/C. J. B. Russell; L.A/C. M. L. Sweet; L.A/C. A. Yoxon.

DIED OF WOUNDS OR INJURIES RECEIVED ON ACTIVE SERVICE.—Sgt. H. G. Elphick; L.A/C. G. R. Methuen.

SERVICE AVIATION

DIED ON ACTIVE SERVICE.—A/C.1 H. Graham; A/C.2 H. Iggulden; A/C.2 A. Kennedy; L.A/C. H. F. W. Patenhall; A/C.2 G. W. Tew.

Royal Australian Air Force

KILLED IN ACTION.—F/O. G. W. M. Harrison.

PREVIOUSLY REPORTED MISSING, NOW PRESUMED KILLED IN ACTION.—P/O. D. H. Bain; Sgt. C. S. Balzer; Sgt. W. T. Jones; Sgt. K. J. Lauder; Sgt. D. R. Rutherford.

WOUNDED OR INJURED IN ACTION.—Sgt. R. P. Howard.

MISSING, BELIEVED KILLED IN ACTION.—Sgt. P. H. Henderson; Sgt. J. B. A. Marshall.

MISSING.—Sgt. M. K. Burke; Sgt. J. R. Burrett; P/O. R. E. N. Butcher; Sgt. J. W. Carnley; Sgt. R. A. Gotts; Sgt. O. L. Hanna; Sgt. J. B. Harden; Sgt. P. R. Mitchell; Sgt. C. E. J. O'Keeffe; Sgt. H. A. Phillips; Sgt. A. C. Rich; Sgt. J. H. Roden; Sgt. G. Scribner; Sgt. H. C. Thompson; P/O. J. S. Ward; Sgt. C. F. Watson.

KILLED ON ACTIVE SERVICE.—Sgt. G. H. Clothier; Act. Flt. Lt. J. A. Falkiner; Sgt. R. G. Cox; P/O. C. A. Fraser; P/O. H. S. Brander; Sgt. F. R. Keys; Sgt. J. T. Sutton; Sgt. F. E. Bishop; Sgt. A. R. Morant; Sgt. S. A. Solomons; Cpl. W. J. R. Hazelton.

PREVIOUSLY REPORTED MISSING, BELIEVED KILLED ON ACTIVE SERVICE, NOW PRESUMED KILLED ON ACTIVE SERVICE.—Sgt. F. S. Warren.

Royal Canadian Air Force

KILLED IN ACTION.—Sgt. J. R. Gibbons.

WOUNDED OR INJURED IN ACTION.—Sgt. D. A. Wright.

MISSING, BELIEVED KILLED IN ACTION.—Sgt. G. L. Fiddler.

MISSING.—Sgt. H. W. Adams; Sgt. J. R. Baillie; P/O. A. Birchall; Sgt. J. L. T. Chartier; P/O. R. F. Chase; Sgt. J. R. Coffey; Sgt. L. S. Ernest; P/O. E. E. Gervais; Sgt. S. G. Gray; Sgt. E. R. Hutton; F/O. A. F. Izzard; Sgt. H. C. Johnston; Sgt. T. H. Miller; Sgt. J. E. Oatway; Flt. Sgt. J. Ott; P/O. I. F. Preston; Sgt. J. M. Rankin; Sgt. S. Ross; Flt. Sgt. W. M. Webb; Sgt. F. A. Youmans.

KILLED ON ACTIVE SERVICE.—P/O. W. H. Bowler; Sgt. J. P. Campbell; Sgt. W. W. Evans; Sgt. M. R. Foran; Sgt. W. B. Fry; P/O. E. V. Garman; Flt. Sgt. N. Hrehorak; Sgt. J. S. Jewett; Sgt. B. A. Kerkhoff; Sgt. R. L. McCulloch; Sgt. M. W. Mazier; Sgt. J. Shea; Sgt. J. F. Teskey; Sgt. J. A. E. Vincent; Flt. Sgt. B. H. Vye; Sgt. W. R. Wynnychuk.

PREVIOUSLY REPORTED MISSING, BELIEVED KILLED ON ACTIVE SERVICE, NOW PRESUMED KILLED ON ACTIVE SERVICE.—Sgt. W. T. Braun.

WOUNDED OR INJURED ON ACTIVE SERVICE.—Sgt. D. G. Murray; Sgt. J. P. Marchant; Sgt. W. J. B. Howell; Sgt. J. B. Shepherd; Sgt. T. A. Deakyne.

DIED ON ACTIVE SERVICE.—L.A/C. J. F. Burns; L.A/C. N. P. Wilson.

Royal New Zealand Air Force

PREVIOUSLY REPORTED MISSING, NOW PRESUMED KILLED IN ACTION.—Sgt. W. D. Stuart.

WOUNDED OR INJURED IN ACTION.—Flt. Sgt. J. D. C. Cumming; Sgt. C. D. Young.

MISSING.—P/O. C. J. McKeen; P/O. L. G. Mee; Sgt. J. A. Morgan; Sgt C. C. Piper; P/O. N. Spence.

KILLED ON ACTIVE SERVICE.—Flt. Sgt. T. W. Shrimpton; Sgt. C. A. Stuart; Sgt. N. C. Turner.

South African Air Force

WOUNDED OR INJURED IN ACTION.—Air Sgt. W. H. Greyvenstein; 2/Lt. R. B. McKechnie.

KILLED ON ACTIVE SERVICE.—Lt. S. D. Davis; Capt. D. J. Jacobs, D.F.C.; Sgt. R. B. Jennings; Air Sgt. W. Weekes.

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Royal Air Force

KILLED IN ACTION.—Sgt. J. E. G. Allwood.

PREVIOUSLY REPORTED MISSING, BELIEVED KILLED IN ACTION, NOW PRESUMED KILLED IN ACTION.—Sqn. Ldr. K. W. Bonnar; Sgt. J. A. G. Firth; Sgt. A. G. Harvey; Sgt. J. N. Hindle; Sgt. N. H. Hood; Sgt. C. P. Russell; Sgt. J. T. Starworth.

PREVIOUSLY REPORTED MISSING, NOW PRESUMED KILLED IN ACTION.—P/O. D. B. Bailey; Sgt. H. Chaplin; Sgt. J. W. Dale; Sgt. J. Hand; Sgt. E. P. Hanrahan; Sgt. S. M. Jones; P/O. W. D. Kennard; P/O. M. O. Ogier; Sgt. J. M. Parker; Sgt. C. R. O. Perry; Sgt. E. C. Reynolds; Sgt. P. Robinson; P/O. J. Spalding.

WOUNDED OR INJURED IN ACTION.—Flt. Lt. P. D. Bowen; P/O. K. V. Calder; L.A/C. M. Kinsella; A/C.1 D. F. R. Shakespeare; Sgt. S. J. Thompson; Sgt. A. J. W. Wilkinson.

DIED OF WOUNDS OR INJURIES RECEIVED IN ACTION.—Flt. Lt. J. Waddingham, D.F.C.; W/O. L. J. Ware.

AT BUCKINGHAM PALACE: A party given to men of the three Services by the "Not Forgotten Association."

MISSING, BELIEVED KILLED IN ACTION.—Sgt. L. A. Biggin; P/O. L. J. A. Graham; Sgt. H. J. Kendrick; Sgt. P. J. Maxwell; Sgt. W. G. A. Mitchell; Act. Sqn. Ldr. R. J. S. Parsons; Sgt. A. G. Sale; Sgt. T. Thompson.

MISSING.—P/O. R. W. Andrew; P/O. W. H. Baker; P/O. R. C. E. Bassom; Sgt. N. G. Beadle; Sgt. J. Bennett; Sgt. E. Benning; Sgt. T. R. Bevan; Sgt. A. G. Boughtwood; Act. Flt. Lt. J. Bryan; Sgt. B. F. Bushell; Sgt. J. C. Caldwell; Flt. Sgt. G. K. Carter; Sgt. W. L. Clough; Sgt. C. N. Coldicott; Sgt. S. Cooper; Sgt. A. McG. Cormack; Sgt. R. S. Darke; Sgt. M. A. H. Dumont; Sgt. E. Dyson; Sgt. A. W. Firth; Sgt. D. C. Garrity; P/O. A. R. Glennie; Sgt. L. W. Goslen; Sgt. W. J. Godley; P/O. C. H. Grant; Sgt. W. Green; Sgt. A. G. Hamlyn; P/O. R. H. Hill; P/O. P. A. Jupp; Sgt. G. D. Kirkby; Sgt. R. Lind; Sgt. J. H. W. Livesey; A/C.2 L. H. Mallinson; Sgt. W. M. Marvin; P/O. G. H. Middleton; Sgt. J. M. S. Moir; Sgt. L. W. Morrison; P/O. G. P. Neville; Sgt. J. Noble; Flt. Sgt. F. Oliver; Sgt. R. S. Otter; Sgt. D. B. Paton; P/O. E. H. E. Perry; Sgt. A. Potts; Sgt. W. G. J. Price; Sgt. J. D. Quilter; Sgt. J. V. Redshaw; Sgt. L. W. Roberts; Sgt. J. M. Robertson; P/O. L. T. Ryerson; Sgt. L. A. Seamark; Sgt. D. P. Shanley; Sgt. J. D. Shaw; Sgt. A. G. Sherrard-Smith; P/O. D. D. Smith; P/O. J. D. Smith; P/O. R. E. Smith; Sgt. C. Stainton; Sgt. F. Taylor; Sgt. A. F. Thomas; Sgt. J. E. Thomas; Sgt. R. G. Thomlinson; Sgt. A. Trewin; Sgt. W. E. R. Wareham; Sgt. J. E. Watts; Sgt. J. Weir; Sgt. L. A. White; Sgt. R. K. Wilson; P/O. G. G. Wright; Sgt. V. Young; Sgt. W. S. Young.

KILLED ON ACTIVE SERVICE.—Sgt. A. W. Anderson; P/O. F. L. Austin; Act. Flt. Sgt. H. C. Baker; P/O. D. R. C. Bartlett; W/O. W. A. R. Bowring; Sgt. R. A. Burman; Sgt. A. Carr; Sgt N. G. Clarke; Sgt. A. T. Clemson; Sgt. A. H. Coalbran; Sgt. J. A. Collum; Sgt. P. E. Cunningham; Sgt. G. Darbyshire; Cpl. R. V. Doak; L.A/C. C. N. F. Downs; Sgt. W. H. Ellwood; Sqn. Ldr. R. Gray; Sgt. F. T. Harrison; W/O. B. Higginbotham; Sgt. H. A. Knott; Sgt. R. N. Leutscher; Flt. Lt. A. G. H. Lindsell; Sgt. J. F. McNamara; Sgt. A. R. Minney; Sgt. F. B. Mitchell; Sgt. E. D. Morgan; L.A/C. J. A. Neild; Flt. Lt. D. S. Parker; Sgt. F. A. Reeve; L.A/C. S. M. Servante; Sgt. C. W. Staley; P/O. B. R. Steel; L.A/C. J. Sutherland; Cpl. H. Todd; Flt Lt. J. E. P. Walford; Sgt. A. V. Watson.

PREVIOUSLY REPORTED MISSING, BELIEVED KILLED ON ACTIVE SERVICE, NOW PRESUMED KILLED ON ACTIVE SERVICE.—Flt. Sgt. J. H. Hibbert; Sgt. A. G. MacKinnon; Flt. Sgt. G. P. Rylands.

WOUNDED OR INJURED ON ACTIVE SERVICE.—A/C.2 H. J. Addison; A/C.2 J. D. Allen; Sgt. W. D. Barr; A/C.1 L. G. Bayliss; L.A/C. F. A. J. Burroughs; Flt. Sgt. E. Chamberlain; Sgt. W. A. Fairweather; Sgt. D. T. Hodgson; Act. Flt. Lt. D. H. Jones; L.A/C. N. L. Moore; Sgt. R. Paterson; Sgt. A. C. Pippard; Sgt. T. Pollock; Sgt. F. D. R. Pullin; Flt. Lt. G. W. Wentworth; Cpl. R. J. Wickson.

DIED OF WOUNDS OR INJURIES RECEIVED ON ACTIVE SERVICE.—L.A/C. J. L. Billinton; Flt. Sgt. K. S. H. Bird; F/O. G. F. Brittlebank; Flt. Sgt. R. M. E. Crofton; Sgt. W. J. C. Roberts; P/O. B. G. Tree; F/O. R. G. M. Wright; Cpl. R. A. Young.

DIED ON ACTIVE SERVICE.—Sqn. Ldr. R. A. Bell-Syer; A/C.2 W. H. Carey; A/C.2 E. Carr; L.A/C. W. L. Douglas; A/C.1 C. Fletcher; Sgt. J. Holland; W/O. W. Huckvale; Sgt. G. F. Jennings; A/C.1 E. A. S. King; L.A/C. J. D. Lorinser; Cpl. W. L. Mackman; A/C.1 A. Meggett; L.A/C. C. K. Pearson; A/C.1 L. W. Rose; A/C.2 V. D. Scholes; A/C.2 W. Smith; Cpl. F. Underwood; L.A/C. D. Wilkinson.

Women's Auxiliary Air Force

DIED ON ACTIVE SERVICE.—L.A/CW. E. Dawson; A/CW.1 C. Lorrison.

Royal Australian Air Force

KILLED IN ACTION.—Cpl. D. H. Nelson; Sgt. T. G. Nicholls; Sgt. E. J. Smart.

MISSING, BELIEVED KILLED IN ACTION.—Sgt. J. M. O. Harris; Sgt. P. T. McLean; Sgt. R. R. B. Owen; Sgt. L. W. Stephenson.

MISSING.—Sgt. N. T. Byrne; Sgt. J. P. G. Reid; Sgt. M. G. Smart; Sgt. T. N. Thomas; Flt. Sgt. C. A. Woods.

KILLED ON ACTIVE SERVICE.—Sgt. K. T. Cadd; Act. Sgt. T. Hogan; Sgt. I. L. Millingen; P/O. A. A. Morris.

DIED OF WOUNDS OR INJURIES RECEIVED ON ACTIVE SERVICE.—Sgt. H. G. R. McCosker.

Royal Canadian Air Force

WOUNDED OR INJURED IN ACTION.—Sgt. J. B Dover; Flt. Sgt. B. E. Innes.

MISSING, BELIEVED KILLED IN ACTION.—P/O. W. H. Donovan; Sgt. S. Feinstein; Sgt. R. K. Griffith; Sgt. J. A. Parker; Sgt. J. O. Tuller; Sgt. R. L. Wakelin; Sgt. G. R. Yeates.

MISSING.—Sgt. M. J. Bracey; Flt. Sgt. P. W. Davis; Flt. Sgt. J. A. Duffield; Sgt. W. V. Emmerlund; P/O. L. E. Hokan; Sgt. S. A. W. Lea; Sgt. V. J. L. Lebano; P/O. R. A. Massey; Sgt. G. E. Miller; Flt. Sgt. W. D. Reynolds; Sgt. R. Sandham; Sgt. W. F. Scott; Flt. Sgt. R. J. Williams; Sgt. R. J. Woodruff.

KILLED ON ACTIVE SERVICE.—P/O. T. R. C. Adams; Sgt. J. R. A. Boudreault; Sgt. D. A. Girouard; P/O. E. P. Howarth; Flt. Sgt. D. G. Jardine; Flt. Sgt. E. Kuzyk; Sgt. N. H. MacKay; Sgt. J. Norman; Sgt. E. C. Plachner; Sgt. R. J. Rioux; Sgt. K. E. Root; Sgt. A. R. Sanger; Sgt. E. W. St. Cyr; Sgt A. Stilin.

WOUNDED OR INJURED ON ACTIVE SERVICE.—Sgt. M. E. Trowbridge.

DIED OF WOUNDS OR INJURIES RECEIVED ON ACTIVE SERVICE.—Sgt. W. H. Backs.

Royal New Zealand Air Force

MISSING.—F/O. D. A. Adams; Sgt. R. H. Cook; Sgt. N. H. Crozier; Sgt. R. J. Gould; Sgt. J. C. Gray; Sgt. J. W. Henry; Sgt. G. E. Langham; P/O. H. F. B. Smith; Flt. Sgt. O. B. White; Sgt. J. M. Welsh.

South African Air Force

WOUNDED OR INJURED IN ACTION.—Lt. A. C. Paterson.

KILLED ON ACTIVE SERVICE.—2/Lt. W. H. Izaaks.